ELECTRICAL REVIEW
AND
WESTERN ELECTRICIAN

VOL. LVI. No. 4. CHICAGO, SATURDAY, JANUARY 22, 1910. ISSUED WEEKLY.

BY THE
ELECTRICAL REVIEW PUBLISHING COMPANY
CHARLES W. PRICE, President and Treasurer.
A. A. GRAY, General Manager. H. S. TUTHILL, Secretary.
C. W. FORBRICH, Assistant Treasurer.

PUBLICATION OFFICE: MARQUETTE BUILDING, CHICAGO

EASTERN DEPARTMENT . . . . . 13 Park Row, New York.
E. E. Wood.
EUROPEAN OFFICE . . . . . 42 Old Broad Street, London, E. C.
Henry W. Hall.

Editors:
CHARLES W. PRICE. A. A. GRAY. F. H. BERNHARD.
Associate Editors:
H. FARRINGTON. H. EHRLICH. C. H. SHAVER.

SUBSCRIPTIONS.

One Year, United States $3.00
One Year, Canada 4.00
One Year, Foreign Countries 6.00
Single Copy, 10 cents. Back numbers, beyond one month, each . .25

Entered as second-class matter, November 7, 1908, at the Post Office at Chicago, Ill., under the Act of March 3, 1879.

CONTENTS.

EDITORIAL:
The Chicago Electrical Show 169
Cost of Power in Two Central Stations 170
Elimination of Grade Crossings 171
Electric Railway Combination Probable in Massachusetts 171
Meeting of the American Institute of Electrical Engineers at Charlotte, N. C. 172
Progress of Electric Railway Construction 172
Imports and Exports of the United States in 1909 172
Ohio Electric Light Association 172
Samuel Insull 173
Power Transmission by Submarine Cable 173
Chicago Electrical Show 174
Postal Telegraph Company to Lose Its Identity 180
Tenth National Automobile Show, New York City 180
Stanley Plant Will Be Enlarged 180
Holding Company Favored 180
Fortieth Annual Meeting and Dinner of the Western Society of Engineers 181
Decisions Affecting Foreign Corporations in Illinois 182
Northwestern Cedarmen's Association Convention 182
Chicago Electric Club 183
Toledo Electrical Show 183
American Institute of Electrical Engineers, 242nd Meeting 184
CENTRAL STATION PRACTICE:
Power-House Economics in Baltimore—III 188
Electricity Progresses in Holyoke, Mass 190
ELECTRIC LIGHTING AND ILLUMINATING ENGINEERING:
The Three-Voltage Rating of Mazda Lamps 191
Illuminating Engineering Society 192
Evidences of Electrification at Niagara Falls by Night 193
INDUSTRIAL POWER:
Electrically Driven Pumps—III 194
ELECTRICAL ADVERTISING AND SELLING:
Advantages of Electric Drive 198
An Active Central Station 200
One Form of Advertising 200
FINANCIAL REPORTS OF ELECTRICAL COMPANIES 201
INDUSTRIAL SECTION:
Chicago Sales and Display Rooms of the Holophane Company 202
Quarry Electrification in Belgium 203
A Combined Tumbler Switch and Circuit Breaker 203
Great Northern Railway Dispatches Trains by Telephone Over 2,100 Miles of Line 204
A Compact Motor-Driven Meat-Chopper 204
New Building for the Guarantee Electric Company 205
Emeralite Desk and Piano Fixtures 205
New York Factory of the Cutler-Hammer Manufacturing Company 206
An Alternating-Current Portable Drill 206
CURRENT ELECTRICAL NEWS 207
RECORD OF ELECTRICAL PATENTS 214

Copyright, 1910, by the Electrical Review Publishing Company.

THE CHICAGO ELECTRICAL SHOW.

Public participation during the first few days of the fifth annual show of the Chicago Electrical Trades Exposition Company, opened at the Coliseum on January 15, indicates the continued interests maintained in the development of electrical apparatus to meet the needs of domestic and industrial work. Notwithstanding the most distressing weather conditions, the attendance was large and the interest manifested keen. Much commendation has been heard of the lighting and decorative effects, which have reproduced a popular stage picture on a large scale with commendable daring and skill.

The wireless telegraph experiments conducted in connection with the Government aeroplane have attracted wide attention, as this is the first attempt which has been made to adopt this means of keeping in communication with this potential air-scout from a ground station. The Coliseum is about as bad a place as possible for initiating the experiment, but notwithstanding the bad structural conditions, to say nothing of "jamming" by other operators, signals have actually been transmitted from the aeroplane as a sending station.

Two problems immediately arise in this connection which will call for experience and high intelligence for satisfactory solution. One is the necessity of providing a stable and thoroughly reliable "ground" within the confines of the aeroplane, and the other is the perfection of a good tape recorder. A free exhaust for the engine is quite essential, and at the same time, the explosions make it nearly impossible for the operator to use the customary headpiece receiver.

Compared with Germany and France we have done little as a Government to foster these experiments. That much has been accomplished is a tribute to the personnel of our engineering officers. It is not because Congress is not willing to make large expenditures where it is apparent that great gains will result. We are slow to change, and hard-headed enough to wait for a good many signs before we will believe. And there are more skeptics than enthusiasts. However, the machine on exhibition at the Coliseum has really made wonderful progress, and every day brings a record of further accomplishments by others. It is futile to make comparisons, for upon close analysis it appears that there have not been parallel conditions confronting earlier

inventions, which ridiculed at first, have come to be of vital necessity to succeeding generations. Past performance, however, and the testimony of those who have made many trips in this form of aeroplane indicate that much can be accomplished by further study. It is hoped, therefore, that if men can be found with the courage to make the practical tests, Congress will see to it that they are not hampered by lack of funds to carry on their work.

COST OF POWER IN TWO CENTRAL STATIONS.

No apology is offered to our readers for the continued emphasis of these columns upon the economic side of power generation in central station plants. So far as available data permit we propose to review from time to time specific instances of station cost analysis, showing as clearly as possible the reasons for the production expenses obtained under stated conditions of operation. It is not contended that new general principles are laid down in analyses of this kind, but it is believed that actual operating figures furnish the best proof of the advantages and drawbacks of various policies in the conduct of electric generating plants. So long as the practice of installation admits of improvement there will be useful lessons in studying with thoroughness the conditions surrounding the production of electricity under varied circumstances of plant equipment, site, fuel cost and labor requirements.

Figures just received from two plants equipped with engines and turbines illustrate again the overwhelming importance of the motor load as a factor in station economy. The first station has a rating of about 2,300 kilowatts, and the second is a plant of approximately 5,000 kilowatt capacity, both being located in the same state and within twenty-five miles of one another. Each plant is of the condensing type, with reciprocating engines and steam turbines operated with good judgment as to the magnitude of the hourly load and the relation of the machine capacity in service to the economy of each unit. In other words, the management of each station strives so far as possible to avoid underloading the equipment, and carries the load from hour to hour upon only such connected capacity at the busbars as will insure reliable and efficient use of steam and coal.

The first or smaller plant is equipped with four Cunningham boilers rated at 150 horsepower each and operating at 125 pounds pressure, one Stirling boiler of 660 horsepower rating, and two Babcock and Wilcox boilers of 650 horsepower rating each. The three last-named boilers are run at 160 pounds, and two are fitted with Roney mechanical stokers. The electrical generating units of the plant consist of one eighteen by thirty-two by forty-two-inch, 400-horsepower, Harris, horizontal, cross-compound condensing engine, belt-connected to a 300-kilowatt alternator, and two Westinghouse-Parsons turbo-alternators rated at 1,000 kilowatts each. All the station output is delivered to the busbars at 2,300 volts, the equipment having been co-ordinated to a single voltage and type of current during the past two or three years. The station payroll covers the services of four engineers, three firemen, two oilers, two coal passers, two switchboard operators, one machinist and one laborer. The situation of the plant on a large river affords an excellent supply of condensing water. The plant burned during the past year 6,076 tons of Cumberland coal at an average cost of $3.97 per ton delivered at the fire room.

The plant generated during the year 3,721,153 kilowatt-hours and sold 2,867,710 kilowatt-hours. Of the latter, 1,702,929 kilowatt-hours, or about sixty per cent of the total energy sales, were used in electric motor service. The maximum load on the station was 1,675 kilowatts. The total cost of manufacture at the busbars for the year was $42,894, or 1.15 cents per kilowatt-hour delivered to the switchboard. The principal items in this total were fuel, $24,127, or 0.65 cents per kilowatt-hour, and wages, $10,663, or 0.28 cents per kilowatt-hour. Oil and waste, water, repairs of station building, steam and electrical equipment, and miscellaneous station tools came to 0.22 cent per kilowatt-hour. Considering the fact that this station is a remodeled installation the above cost of production represents better practice than the average in many plants of its size.

The second or larger station is equipped with two 350-horsepower boilers and six 400-horsepower boilers, all being of Babcock & Wilcox make, and operating at 120 pounds steam pressure. There are six electric generating units, two being Curtis turbo-alternators of 1,500-kilowatt rating, and the rest reciprocating engines driving direct-connected generators. The engines include one twenty-four by forty-eight-inch Allis-Chalmers horizontal compound condensing machine, and three E. P. Allis twenty-two by forty-two by forty-eight-inch units of 900 horsepower rating each. The engines drive one 800-kilowatt alternator and three 450-kilowatt alternators. The standard potential of distribution in the second plant is 2,300 volts. There are also in the station three small power generators, belt-driven, rated at 186 kilowatts each, and supplying a limited service at 500 volts, direct current.

The operation of the larger plant requires the services of six engineers, four oilers and cleaners, six firemen, three coal passers, and four switchboard men. The fuel consumption for the year was 12,118 tons of bituminous coal costing an average of $3.05 per ton delivered at the station. The plant is located on tide water, and is fully equipped with condensing machinery. The total generated output of the station for the year was 8,800,828 kilowatt-hours, of which 7,094,723 kilowatt-hours were sold. The total power sales were 2,977,674 kilowatt-hours, or forty-two per cent of the total sales. The maximum load on the station was 3,350 kilowatts. The total cost of manufacture, excluding all fixed charges as in the case of the first plant was $86,762, or 0.99 cents per kilowatt-hour at the busbars. Fuel expense came to $36,980, or 0.42 cent per unit, and labor at the station to 0.28 cent per

kilowatt-hour. The other expenses as listed in the first plant, came to 0.29 cent per unit.

These figures show that even an old plant which has been remodeled by the elimination of small scattered units and line shafting, with the introduction in certain cases of steam turbines of modern design, may produce electricity at first class economy of equipment, if the load factor is kept high by the cultivation of a large day load. In each of the two cities served by these installations the power business is of an extremely varied character. Motors are used in driving shoe machinery, machine shops, printing plants, elevators, cash systems, ice cream freezers, saws, dental equipment, fans, signs, and other diversified industrial tools. The results gained depend somewhat upon a favorable initial cost of coal, but it is noteworthy that the difference in plant generating expense is in each case attributable mainly to the difference in the primary cost of fuel. The larger station operates at a slightly better rate per kilowatt-hour, showing three and three-tenths pounds against three and six-tenths pounds in the first plant. The benefits of the day load are not open to question, however, in the face of these results, compared with those in plants of the same size which do mainly a lighting business.

ELIMINATION OF GRADE CROSSINGS.

There has been no reform in a number of years which has so intimately concerned the safety of the traveling public as has the elimination of crossings of highways and trolley roads with railroads on the same level. The question is especially important in the case of a trolley line crossing the tracks of a steam railroad, for the conditions are often such that a clear view of the railroad track is not to be had by the motorman until he is dangerously near the crossing. While it is true that nearly every trolley line has a rule which is supposed to compel the motorman to come to a full stop before making the crossing, the facts in many accidents have shown that this is not always done.

A feature quite aside from safety, is that there can not fail to be a marked improvement of schedule time on interurban lines when a stop before crossing a railroad track is no longer necessary. It is frequently the loss of time which tempts the motorman to risk crossing without first stopping.

Even a glance at some of the carefully guarded grade crossings in Europe, and an inspection of the statistics showing the notable lack of accidents due to railways there, will convince anyone that we have much to accomplish either in protecting such crossings as we have or in establishing a kind which needs no protection, preferably the latter.

Much has already been done in certain of our cities by the enactment of ordinances whereby the city shares the expense of the work of elevating the tracks with the railway company. In Chicago an ordinance was passed some years ago providing for the elevation of the tracks of all railroads crossing the streets and many of the tracks have since been raised. It was estimated at the time of passage of the ordinance that no less than a person a day was killed in grade crossing accidents.

New York state is perhaps foremost, as a state, in the work of making safe crossings, and since the passage of the grade-crossing law there have been eliminated 233 of these death traps and work on several more is now in progress. The state pays one-fourth of the expense of the work of elevating the tracks at crossings and has already spent more than one and a half million dollars as its share.

As such improvements can not fail to benefit the trolley companies, as well as the public in general, it is but fitting that they should use their influence to bring about the abolition of crossings which not only make their schedules poor, but are a constant menace to their property.

ELECTRIC RAILWAY COMBINATION PROBABLE IN MASSACHUSETTS.

More than half the electric railway mileage of Massachusetts will be under a single management within a short time if the present Legislature follows a recommendation of the Railroad Commission and the Boston Transit Commission that the Boston Elevated Railway Company be permitted to acquire control of all the suburban and interurban systems now connecting with its tracks. In an exhaustive report to the Legislature this joint commission prints out the economies of such a 1,700-mile consolidation from the point of view of the companies and the public, showing that under proper state supervision the service may be improved, rates perhaps lowered in certain cases, and the costs of operation and management cut down.

Experience in the Middle West strengthens this view and, in lesser degree, the benefits following the consolidation of companies in the East have been demonstrated when under able management. Conditions differ between Indiana and Massachustts, but in each case the avoidance of duplication of equipment and administrative organization, the extension of through car service, sale of through tickets, and reduction of running time made possible by the elimination of delays at system terminals and junctions, as well as the more economical purchase of supplies and the raising of the standards of rolling stock, have inured to the benefit of the public and the companies alike.

It is interesting to consider how far such combinations are likely to be carried, when in the future interstate groups of lines may profitably be merged. Probably too much emphasis is laid upon the maximum distance which patrons may ride in large trolley systems, for until schedule speeds are radically increased it is going to be difficult to compete with the trunk lines at present rates for long-distance business. Much can be done, however, by breaking away from provincial methods of operation and subordinating local house-to-house methods to the practice of faster and more comfortable through service.

Meeting of the American Institute of Electrical Engineers at Charlotte, N. C.

At the meeting of the Board of Directors of the American Institute of Electrical Engineers held on December 16, 1909, a resolution was passed authorizing the meetings and papers committee to arrange for a meeting of the Institute at some suitable point in the South Atlantic states during the month of March, 1910.

The meetings and papers committee has decided that the meeting shall be held at Charlotte, N. C., on March 23, 24 and 25, 1910. The programme has not yet been completed, but arrangements have already been made for the presentation of the following papers: "Economics of Hydroelectric Plants," by W. S. Lee; "Electric Drive in Textile Mills," by A. Milmow; "Calcium Cyanamide and Its Relation to Water Powers," by Charles H. Baker; "Gas Engines in City Railway and Light Service," by E. D. Latta, Jr.; "Protective Devices for High-Tension Transmission Lines," by L. C. Nicholson. In addition to a number of attractive social features, the Southern Power Company has offered to place at the disposal of the members in attendance a special train for a tour of inspection of its Great Falls station at Great Falls, S. C., and a 100,000-volt substation.

The official headquarters will be at the Selwyn Hotel. A local committee of arrangements has been appointed by President Stillwell, and is constituted as follows: W. S. Lee, chairman, Dr. W. Gill Wylie, John H. Finney, C. E. Waddell, J. E. Sirrine, W. M. Riggs, A. M. Schoen, S. W. Cramer, E. D. Latta, Jr., P. M. Laxton, E. P. Coles, F. D. Sampson, C. I. Burkholder, R. R. Laxton and J. W. Fraser. It is hoped that a representative attendance, especially of the southern membership, will be present.

The Charlotte meeting is not to take the place of the Institute's annual convention, which will be held as usual later in the year at a place not yet decided upon.

Progress of Electric Railway Construction.

The subject of "Electric Railways from a Construction and Maintenance Standpoint During the Year 1909" was treated in a report of the electric railroad committee at the thirteenth annual meeting of the Indiana Engineering Society held in Indianapolis on January 13, 14 and 15. The report stated that Indiana, through consolidation and mergers, now has thirty-one systems of interurban lines with a total length of 1,708 miles of main track. The Indianapolis, Newcastle & Toledo Electric Railroad Company with forty-six miles of track and the Winona Interurban with twenty-two miles of track which are about completed are not included in the foregoing.

The closing of the gap between Warsaw and Peru is important in that it opens for through electric travel the territory from Louisville, Ky., via Indianapolis, Peru and South Bend to Chicago and into Wisconsin as far north as Sheboygan, and also offers through travel east and west from Sheboygan, Wis., via Chicago, Indianapolis, Cleveland and Buffalo to points in Central New York.

There still remains a gap of about twenty miles in Illinois, which prevents through traffic from St. Louis, Mo., to Indianapolis, via Paris, Ill., and Terre Haute. When this is completed through trolley traffic between St. Louis and points in Central New York will be possible. S.

Annual Dinner of the American Institute of Electrical Engineers.

Arrangements are being made for the next annual dinner of the American Institute of Electrical Engineers. It will be held at the Hotel Astor in New York city on Thursday evening, February 24. Prof. Elihu Thomson, who is to receive the first award of the Edison medal, will be the guest of honor.

Imports and Exports of the United States in 1909.

The monthly statement of imports and exports issued by the Bureau of Statistics of the Department of Commerce and Labor today presents figures for the month of, and the twelve months ending with, December, 1909, compared with like periods in 1908. The December imports were $138,742,292, an increase of $26,821,730 over those of December, 1908; exports $171,662,197, a decrease of $17,168,710 compared with December, 1908. For the twelve months ending with December, 1909, the imports were $1,475,520,205, an increase of $359,146,118 over last year; exports $1,727,383,128, a decrease of $25,452,319 compared with the preceding year. The excess of exports over imports in the twelve months ending with December, 1909, is $251,862,923, a decrease of $384,598,437 when compared with last year. Imports are fifty millions greater than in the earlier high record year, 1907; exports are about twenty-five millions less than 1908, and nearly 200 millions below 1907. The increase in imports occurs chiefly in manufacturers' materials; the decrease in exports occurs chiefly in foodstuffs.

Ohio Electric Light Association.

The sixteenth annual convention of the Ohio Electric Light Association will be held on July 26, 27 and 28, 1910, at Cedar Point, Ohio. This place will be remembered as the point on Lake Erie across the bay from Sandusky that was visited by the association on its excursion at the close of the convention last July. The executive committee at its midwinter meeting at the Chittenden Hotel, Columbus, Ohio, on January 12, not only fixed the time and place for the next convention but also drew up a tentative programme of subjects to be discussed. Among these topics, on which papers are expected to be presented, are the following:

Experience with series tungsten lamps for street lighting; what is being done with electric vehicles in Ohio; electric heating devices and their progress; turbine troubles; methods of charging for power; best methods of metering current when sold for power, and maintenance of such meters; central-station facts and factors; low-pressure turbines and their operation; what course should be pursued in getting new business in cities of 15,000 and less and in villages. Two other papers, on subjects to be announced later, are also expected. The programme of entertainments for this convention will in all likelihood be more elaborate than ever.

Boiler Settings.

In the course of a paper on "Economic Setting of Steam Boilers," recently read by M. Sykes before the Leeds (Eng.) University Engineering Society, the author pointed out the folly of firms who after paying for the best materials and workmanship for the boiler itself, intrusted the setting to a common bricklayer instead of engaging the services of an expert, thereby seriously affecting the economy, efficiency and longevity of the boiler.

Samuel Insull.

Samuel Insull takes a leading part in the financial and corporation life of Chicago, the great metropolis of the West. Due to his enterprise and faculty for building up efficiency in organization, the Commonwealth Edison Company is the leading central station for the supply of current for electric light and power in this United States of America.

Mr. Insull was born in London, Eng., on November 11, 1859. He came to the United States in February, 1881, becoming private secretary to Thomas A. Edison, of whose business affairs he had full charge for many years. He represented Mr. Edison in the organization and management of the Electric Tube Company, the Edison Machine Works and the Edison Lamp Company. When the various Edison manufacturing concerns were consolidated with the Edison Electric Light Company into the Edison General Electric Light Company, Mr. Insull became second vice-president in charge of the manufacturing and selling departments. When this company was consolidated in 1892 with the Thomson-Houston Company as the General Electric Company, Mr. Insull became second vice-president of the consolidated company. He resigned in June, 1892, shortly after becoming president of the Chicago Edison Company. On the organization of the Commonwealth Electric Company he became its president. When these companies were consolidated into the Commonwealth Edison Company, in 1907, Mr. Insull continued as president, controlling substantially the entire electric light and power business of Chicago. Mr. Insull is also president of a number of other public service corporations. He is a member of the American Institute of Electrical Engineers, of the British Institution of Electrical Engineers, and of the National Civic Federation. Quite recently Mr. Insull took a prominent part in the shaping of events leading up to the consolidation of a number of the South Side surface electric railway properties in and near Chicago into one big centralized organization. Mr. Insull is active in every movement for the civic social uplift in Chicago, and is prominently identified with the strong and progressive civic organizations for which this city is famous. He is a member of the Chicago Club, the Chicago Athletic Club, the Union League Club in Chicago, the Lawyers' and Engineers' clubs in New York, and the Whitehall and Devonshire clubs in London. Five years ago the Electrical Trades Exposition Company was formed in Chicago for the purpose of holding annually a mammoth electrical show which would bring before the public the latest products in the electrical art. The first show was a tremendous success, and the succeeding exhibitions have worthily followed the inaugural event. The fifth annual show was opened on Saturday, January 15, and will continue at the Coliseum until January 29. Throughout the five years of the Exposition Company's life Mr. Insull has been the leading spirit of the organization, and has assisted largely in making the Electric Show one of the events of the year.

SAMUEL INSULL.
President of the Commonwealth Edison Company.

Electric Pumping in Chicago.

It is understood that the Sanitary District may shortly install two direct-connected centrifugal pumps, driven by an electric motor between them, at the Harrison Street pumping station in Chicago. This outfit would be connected to the city mains and the current to operate the unit would be furnished to the city at the regular municipal rate of $26.40 per horsepower per year, plus an interest and depreciation charge on the cost of the equipment, which is approximately $10,000. From the guarantees furnished by the builders of the pumps and motors, it is estimated that the new installation would make it possible to deliver water into the drains at a cost of 0.3 of a cent per thousand gallons. The proposition is still awaiting consideration by the city authorities.

Power Transmission by Submarine Cable.

An instructive instance of long-distance transmission of power is furnished by the Helsingborg-Helsingöre service, says *The Electrical Engineer,* of London, Eng. Close by the town of Helsingborg, in Sweden, the river Laga has a sudden fall of over 300 feet, and this has been utilized for the establishment of a hydroelectric station. The power so generated is conveyed by cable over a few miles of land to the coast, and there by submarine cable across the narrow seas (about three miles) to Helsingöre in Denmark. The distance is not very great as such things go, certainly very much less than many others both in Europe and America, but the two peculiarities here are the facts of a submarine cable being used and that the undertaking is of an international character — the force of a Swedish river being utilized for running Danish industrial and domestic appliances.

Ozonizers for St. Petersburg Water.

The St. Petersburg Municipal Duma and city authorities have decided to install electric ozonizers for sterilizing the drinking water in that city.

CHICAGO ELECTRICAL SHOW.

FIFTH ANNUAL EXHIBITION, AT THE COLISEUM, JANUARY 15-29.

The fifth annual electrical show of the Chicago Electrical Trades Exposition Company was opened on January 15 at the Coliseum with all exhibitions in place and a large and enthusiastic attendance on hand. The great amphitheater is a scene of dazzling light and color, with its myriad of high-efficiency incandescent lamps, softened by art glass effects, and a canopied dome of incandescent gold and silver tinsel reflecting the rays of two batteries of Ryan scintillators.

Each booth is lighted by a cluster of tungsten lamps with Holophane reflectors, the cluster being partially shaded by an imitation art glass dome. The corner posts and newels are surmounted by art glass domes, within which are high candle-power incandescent lamps. From the corner posts loops of bunting are caught up to form an apex over the cluster of lamps at the center of each booth. Surrounding the great hall, around the balcony rail, is a frieze, bearing escutcheons, spaced on twenty-two-foot centers, made up of imitation art glass and illuminated by incandescent lamps.

The officers of the Chicago Electrical Trade Exposition Company are: President, Samuel Insull; vice-president, E. B. Overshiner; secretary and treasurer, Stewart Spalding; manager, Homer E. Niesz. The directors are Samuel Insull, T. P. Gaylord, E. B. Overshiner, G. H. Atkin, Stewart Spalding, Geo. B. Foster, F. V. Bennis, Louis A. Ferguson, W. W. Low.

Suspended from the roof trusses, in the center of the exhibit space is the Wright aeroplane, which has been lent by the War Department. This is the famous heavier-than-air flying machine built by Wilbur and Orville Wright for the United States Government and which met the Government specifications after a series of brilliant flights. The Government exhibit is in charge of Lieutenant B. D. Foulois, who is assisted by six men from the aeronautical squad of the Signal Corps.

A casual inspection of the historical Wright aeroplane, now owned by the United States Army, hanging overhead in the Coliseum could hardly be expected to reveal a most interesting bit of wireless construction. However, people visiting the Chicago Electrical Show without explanation would not realize that this heavier than air machine is the first aeroplane that has ever been fitted up with wireless telegraph apparatus for practical service.

In presenting the Wright aeroplane in combination with the wireless telegraph, and, probably, wireless telephone, the purpose of the government and the Exposition Company was to place before the people of the great West a combination of two of the greatest wonders of the age.

It should be borne in mind, however, that previous to this occasion no wireless message has ever been sent to or from an aeroplane. It is understood, therefore, that the Signal Service, in consenting to equipping the government aeroplane in the Coliseum with wireless telegraphy, naturally does not wish the exhibit to be looked upon as anything more than a very rough experiment under the most disadvantageous circumstances. In fact, owing to the immense amount of metal in the Coliseum, the supporting and guy wires for the aeroplane, the network of electric wires, cables and other metallic obstructions throughout the building,

GENERAL VIEW OF FIFTH ANNUAL ELECTRICAL SHOW, COLISEUM, CHICAGO, ILL., JANUARY 15-29.

no tests from the aeroplane to the ground station in the annex, or from the station to the aeroplane can be looked upon as being conclusive.

In fitting up the aeroplane, however, with its wireless equipment, Lieutenant B. D. Foulois, the Signal Service officer, in charge of the exhibit, in conjunction with Frank L. Perry, of Chicago, has devised a system of antenna and wiring in combination with the army portable wireless telegraph set that will likely be tested thoroughly later on in the experiments which Lieutenant Foulois expects to carry on during his flights over the plains of Texas.

NIGHT VIEW OF COLISEUM EXTERIOR, ILLUMINATED WITH TWELVE ALBA FLAMING ARC LAMPS.

AISLE VIEW, SHOWING PORTION OF INDUSTRIAL EXHIBIT OF COMMONWEALTH EDISON COMPANY.

To anyone who has not given the subject much study, it would seem to be an extremely simple matter to lay out a system of antenna in and about the aeroplane. It was found, however, that owing to the surprising number of wires, braces and other metallic parts in the Government aeroplane it was, to the contrary, quite a problem. With the realization that it was decidedly inadvisable to have any loose or hanging wires attached to the aeroplane owing to the revolving propellers, the possible action of the air during flight, together with the fact that the aeroplane often has to run along close to the ground, etc., Lieutenant Foulois in this first experimental outfit confined the antenna wires within the outside dimensions of the aeroplane.

The top antenna consists of three horizontal parallel, overhead, stranded, copper wires about No. 14 in size, strung along just beneath the upper plane of the two main surfaces of the aeroplane.

This upper antenna "surface" is maintained in position on a system of porcelain cleat insulators supporting the antenna at its extremities. The wireless army telegraph sending and receiving set may be seen in the photograph located just behind the aviators' seats in the aeroplane. One stranded wire from this wireless set makes connection at the center point of the three-wire overhead antenna system.

No little difficulty was found in plotting out the position of the lower antenna.

As it was desired to produce, in effect, a vertical Hertzian oscillator within the confines of the aeroplane's outside dimensions, Lieutenant Foulois and Mr. Perry figured that a loop of wire strung around the lower edge of the aeroplane's "runners" would best accomplish the result. Further, from an aviator's standpoint, Lieutenant Foulois felt that such an arrangement of the lower antenna would not in any way interfere with the starting or landing of the aeroplane in actual service. Connection from this lower antenna loop around the aeroplane's runners, is made by two wires brought up from the antenna proper, through a rubber tube set in the muslin of the lower plane, to the wireless set just alongside of the aeroplane engine.

Messages were received in the annex at the Signal Corps wireless station by Lieutenant Foulois's operators within a few hours after the hanging of the aeroplane.

It is Lieutenant Foulois's purpose not only to experiment with wireless telegraphy, but it is his plan later on during the exposition period, to utilize some experimental telephone apparatus from Mr. Perry's laboratory with the idea of carrying out Major G. O. Squier's wishes that every possible opportunity be utilized for preliminary experiments in wireless telegraphy.

Relative to the receiving station "on the ground," so to speak, in the annex of the Coliseum, this consists of an army tent within which are placed the regulation Signal Corps wireless sending and receiving sets.

The regular army antenna pole and "umbrella antenna" has been set up and messages are every few minutes dispatched to and from the aeroplane and this station on the ground.

In addition, there is within the confines of this space a very beautiful exhibit of aeronautical pictures that about

one year ago were presented by Major G. O. Squier, of the Signal Corps, to the American Society of Mechanical Engineers after his lecture on "The Present Status of Military Aeronautics."

Afternoon and evening concerts are given by John C. Weber and his "Prize Band of America," assisted by Miss Blanche Berndt-Mehaffey, soprano.

By far the most extensive exhibit is that of the Commonwealth Edison Company, where neither expense nor effort has been spared to encompass a comprehensive representation of the adaptability of electricity to every phase of domestic and industrial endeavor. Clear across one end of the Coliseum there is a power exhibit, a feature of which is a complete printing plant equipment, where a daily issue of the *Electric City* is published. Here is a working exhibit of typesetting and casting machines, printing presses, folding machines, wire stitchers, cutting machines, electrotyping machines and auxiliary apparatus. A complete pamphlet, in colors, is also being published for distribution to the visitors. This department is under the direct supervision of Dana Howard, advertising manager, and H. A. Seymour, editor-in-chief of *Electric City*. The next section of its space is fitted up as the office of the exhibit and the headquarters for the distribution of printed matter. Information is also freely given out in this section. The adjoining space is occupied by a complete equipment of tinware machinery, including punch presses, electric soldering irons, crimping machines, etc. Here cookie-cutters are cut, stamped and soldered and distributed as souvenirs. An interesting application of electricity is found in the next section, which contains individual, motor-driven, automatic bolt cutters, rivet spinners, hack-saws and a punch press. There is also a complete outfit of electric tempering and hardening apparatus. The last section of the exhibit is devoted to artificial refrigeration, there being shown a large butchers' ice chest and show case supplied with cooled air by an electrically driven ice manufacturing outfit. In another aisle there is a handsomely fitted booth in which is shown a number of portable electric lamps, art glass shades and fittings. These are supplied by the Electric Shop of the Commonwealth Edison Company. An interesting feature of the Commonwealth Edison exhibit is in the Annex, wherein it has installed a Karr portable garage, equipped with mercury arc rectifiers which charge storage batteries on an electric vehicle. There is also installed a permanent garage equipped with mercury arc rectifiers and electric tire pumps for inflating automobile tires. Various other apparatus commonly found in a garage is also shown, all being electrically driven.

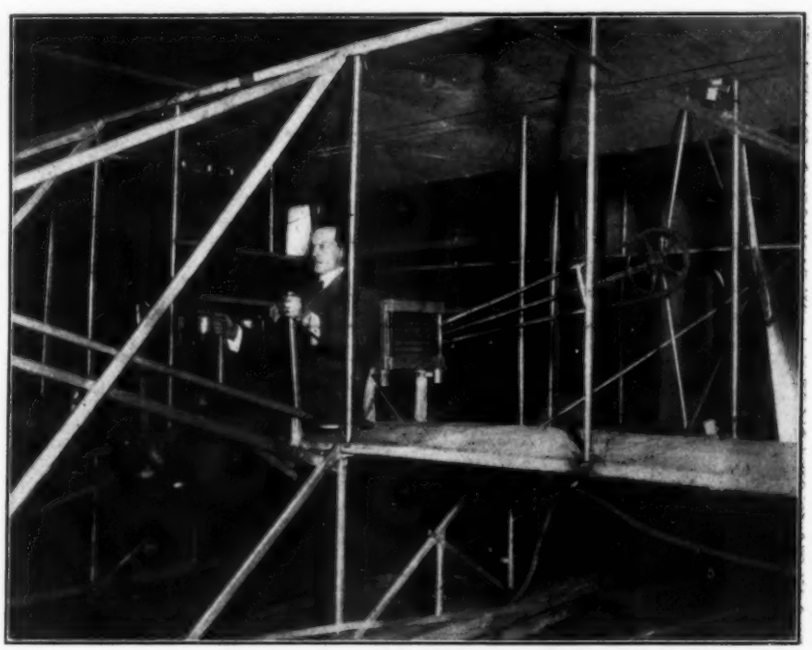
LIEUTENANT B. D. FOULOIS.

The Allis-Chalmers Company, Milwaukee, Wis., has on exhibition a very complete line of electrical machinery, among which may be mentioned one thirty-horsepower, alternating-current motor; one portable air compressor, eleven cubic feet capacity, driven by a 115-volt, sixty-cycle, three-phase alternating-current motor; one model steam turbine; one fifty-kilovolt-ampere, one twenty-kilovolt-ampere, one five-kilovolt-ampere and one two-kilovolt-ampere transformer. All of these machines, with the exception of the steam turbine are in operation. The following members of the Allis-Chalmers sales staff are in attendance: J. W. Gardner, Chas. M. Howe, S. R. Kerr, C. S. Buell, A. W. Catlin, K. D. Chadbourne, J. M. Denniston, Ervin Dryer, R. H. Gaither, C. M. McDonald, C. M. Nicholson, J. C. Orrell, L. St. John Smith, F. von Schlegell, E. W. Linquist. The exhibit is in charge of F. G. Bolles, commercial engineer.

The Acme Wire Company, New Haven, Conn., is showing a representative line of goods, a special feature of which are automatic machine wound field coils. This company is also exhibiting samples of solenoids as well as railroad signal coils, wattmeter coils, telephone coils, secondary coils, etc. Also a line of the new magnet wires, such as "Enamelite," "Silkenite" and "Cottonite" insulation. P. C. Ackerman, E. L. Hartpence and W. H. Balke are in attendance.

The American Telephone and Telegraph Company is exhibiting jointly with the Chicago Telephone Company. They have two booths installed and operate a long-distance pay station at the exposition during the day and in the evening use these booths to demonstrate their service to the larger cities. Albert Douglas special agent, is in charge.

The American School of Correspondence, Chicago, Ill., has a very attractive booth, in which is displayed all of the text books of the school and where the various courses of instruction are fully explained. Sample copies of the school's publications are distributed to the visitors. The exhibit is in charge of M. L. Brantingham, A. R. Hodge and O. C. Miller.



NEAR VIEW OF AEROPLANE, WITH AVIATOR IN SEAT.

The American Sign Company, Kalamazoo, Mich., has on exhibition a large electric sign, in which the lamps are mounted in the rear of the board and the light distributed through magnifying lenses. The exhibit is in charge of Geo. D. Bailey, representative of the firm.

The American Steel and Wire Company, in addition to several attractive sample

boards containing samples of rubber-covered wire, weather-proof wire, lead-enclosed cables, trolley wire, lamp cord and other of its products, has on exhibition various types of rail bonds and tools for applying the same. The application of these bonds is demonstrated on actual rails, a section of a track being included in the exhibit. B. H. Ryder of the sales department is in charge of the exhibit.

The Appleton Electric Company, Chicago, Ill., is making an exhibit of a comprehensive line of conduit fittings including unilets, cast and stamped steel outlet boxes and covers, no-thread outlets, switch boxes, bushings, pipe straps, fuse wire, fuses and telephone blocks and fuses. A special feature of the exhibit are the sheradized and buffed fittings. R. P. Tillotson is in charge of the booth.

Automatic Printing Press Company, Chicago, Ill., has on exhibition an electric printing press which is kept busy printing cards for the visitors.

The Bishop and Babcock Company, Chicago, Ill., is exhibiting two styles of Eureka automatic electric water lifts and two types of Eureka automatic electric air compressors. Those in attendance are Cooper Lyon, H. G. Kastilahn, A. H. Lewis, R. S. Michalis, E. Collins, W. Zimmer and E. McQuire.

The Como Electrical Company, Spring Lake, N. J., is exhibiting Hickley's patent alternating-current rectifiers and Hiko compounds. Robert Boone and A. S. Hickley are in attendance.

The Collins Wireless Telephone Company, Newark, N. J., has on exhibition a complete wireless telephone outfit and in addition the Collins-Sanchez high frequency apparatus for use of doctors and physicians. The company is represented by A. Frederick Collins, A. C. Lowenjhelm Kopp, Senor Monico Sanchez, Edw. S. Canman and J. W. Egbert.

The Chicago Fuse Wire and Manufacturing Company, Chicago, Ill., is exhibiting very fine display boards especially prepared for the show on which are exhibited a representative line of conduit outlet boxes and covers and switch boxes, also enclosed fuses and blocks, fuse wire and fuse links. The following representatives are in attendance: A. S. Merrill, George C. Reid, Walter D. Dana, Joseph Pearson, G. E. Harland, Clarence T. McDonald, Milton Mill and W. W. Merrill.

The Chicago Pneumatic Tool Company, Chicago, Ill., has on exhibition standard portable electric tools, including drills, grinders, hoists, etc., as well as representative tools of its line of pneumatic apparatus. There is also shown a number of new types of drills and grinders, among which is a line of side spindle drills and tools for heavy reaming. Those in attendance are: C. B. Coates, Edward Aplin, Charles H. Schumacher, Paul Jahn, Chas. Hayes and L. H. Conover.

The Crane Company, Chicago, Ill., is exhibiting Cranetilt steam traps, electrically-operated emergency stop valves and gate valves. In addition to these exhibitions, which are shown in actual operation, there are several samples of the Crane products shown, such as valves, pipe fittings, castings, etc. A feature of this latter exhibit is a section of bent pipe. Those in attendance are F. C. Sabin and W. L. Goddard.

The Cutler-Hammer Manufacturing Company is maintaining a pleasant reception headquarters, in charge of R. M. Van Vleit. This booth is also the headquarters of the Sons of Jove, of which Mr. Van Vleit is Mercury.

The Del Sales Company, Chicago, Ill., has on exhibition electric curling irons and other electric heating devices. A feature of this exhibition is the electric soldering iron, all elements of which are changeable. W. N. Williams and T. M. Caven are in attendance.

The Duntley Manufacturing Company, Chicago, Ill., has an attractive booth, in which is shown six sizes of the Duntley electric vacuum cleaner. There is also shown a gasoline electric vacuum cleaner, the Duntley electric air washer and purifier, and a line of imported electrical specialties. The exhibit is in charge of J. R. Harrison.

The Driver-Harris Wire Company, Chicago, Ill., exhibits its line of resistance alloys in the form of round and flat wire. It displays "Nichrome" wire glowing at working temperature in the open air; "Climax," a nickel steel alloy; "Advance," a copper nickel alloy, and "Monel" metal are among the other alloys shown. The exhibition is in charge of Arlington Bensel, assisted by E. G. Duble.

The E-Z Vacuum Cleaner Company, Chicago, Ill., has on exhibition its electric and hand-power vacuum cleaner. C. W. Lasher, Jr., and Forest O. Poor are in charge of the exhibit and are assisted by the sales force of the company.

The Electric Cleaner Company, Chicago, Ill., has on exhibition "Reliable" and "Positive" types of its portable vacuum cleaners. These are subjected to severe tests by the operator. In addition, various fittings and tools for the cleaners are shown and their application demonstrated. The booth is in charge of A. M. Rodger and B. P. Bates.

The Electro-Magnetic Tool Company, Chicago, Ill., has an atractive exhibit, which consists of electric hammers, showing these tools in operation on different kinds of material. The company is represented at the exhibit by Messrs. Rowe, Knowlson, Elder and Ufer.

The Empire Vacuum Company, New York, N. Y., is exhibiting and demonstrating its fifty-pound portable vacuum cleaner, and also vacuum cleaners adapted for railway car cleaning. The company is represented by C. O. Adams and V. R. Nevius.

The Electric Storage Battery Company, Philadelphia, Pa., exhibited duplicate sets of "Exide" batteries as furnished for a large number of the standard makes of electric vehicles. This company also has on exhibition a number of cells of "Exide" batteries used in various makes of gasoline automobiles, as well as samples of the battery plates and parts for the batteries. An interesting feature is the "Hyray" electric lighting outfits shown which are designed for use on both the gas and electric cars. The "Hyray" electric lighting outfit is becoming particularly popular among automobile users.

The company is represented by some of the officials of the company, as well as by representatives from its sales offices.

The Electrical Testing Laboratories, New York, N. Y., shows the color values of modern electrical illuminants, with the aid of specially constructed booths which conceal the lamps while displaying the characteristics of the light. The appearance of colored fabrics when illuminated by the lamps affords an interesting study of light quality. The relative brightness of screens illuminated by the lamps illustrates the great progress that has recently been made in the efficiency of electric illuminants.

The Enterprise Optical Manufacturing Company, Chicago, Ill., is demonstrating the Motiograph Motion Picture Machine, and two instruments for the saving of electric current, one for alternating and the other for direct current.

Everson & Company, C. G., Chicago, Ill., is displaying a few styles of tungsten shower effects for general effective lighting and in addition to this exhibit a very extensive and complete line of water purifiers and coolers for the requirements of the home, offices, factories and public institutions. C. G. Everson is in charge, assisted by R. B. Everson.

The Excello Arc Lamp Company, New York, N. Y., is showing the different styles of Excello arc lamps, including the rocker beam type for alternating current or direct current, also the compensating type for alternating current or direct current. This lamp is designed for operation on 220 to 600 volts. There is also on exhibition the Axis type lamp. This lamp has vertical carbons similar to the enclosed arc lamp, except that both carbons are moveable, the upper one feeding down and the lower one up, so that the arc is always maintained in one position. In addition there is also shown different styles of glassware, including the prismatic inner globe showing how different distributions of light can be accomplished by the use of the proper glassware. W. J. Gille is in charge.

The Fairbanks Morse Company, Chicago, Ill., has an attractive booth wherein is exhibited a seventy-five-kilovolt ampere engine-type alternator, a fifty-horsepower induction motor; low-voltage squirrel-cage induction motors; a thirty-horsepower B. H. type alternating-current hoist; thirty, twenty and ten-horsepower direct-current motors; and automatic starters of various types. A special feature of the exhibit is the Fairbanks Morse standard lighting plant for country residences, which is shown in operation and which supplies the current for the brilliant booth illumination. This plant consists of a gasoline engine, a generator, switchboard and the plant is said to be remarkably composite and efficient. It places within the reach of the farmer all the conveniences of electric light and power service obtainable in cities. The company is also exhibiting a full line of Monarch incandescent lamps. J. Osborn, M. Southworth, O. A. Reed, J. M. Johnson and E. K. Seymour are in attendance.

The Federal Electric Company, Chicago, Ill., has on exhibition a complete line of electric signs, using both carbon and tungsten lamps, tungsten flasher signs, "Adlite" window lighting devices, the Federal vacuum cleaner, tungsten fixtures and clusters, Federal shaving mirrors and portable lamps. An interesting feature of this exhibition is an automatic kitchen, which consists of motor-driven coffee grinder, meat chopper, egg beater, dough mixer, etc., all mounted on a single table. The exhibition is in charge of F. H. Welling.

The Fort Wayne Electric Works, Fort Wayne, Ind., has on exhibition a complete line of apparatus which consists of an assortment of small motors from 100 horsepower up to and including one-quarter horsepower; a five-horsepower, type FF direct-current motor; a five-horsepower, alternating-current, three-phase motor; a five-kilowatt type A transformer; a cross-section of type A transformer; a sixty-cycle calibrator, new style; two type K-2, 110-volt, sixty-cycle wattmeters; a type SBB wattmeter; a type SBA wattmeter; two of the above wattmeters with glass cases; a current transformer; a potential transformer; a direct-current compensarc, 220-volt; an alternating-current, sixty-cycle compensarc, and three new Wayne bell-ringing transformers. In addition the Fort Wayne Engineering and Manufacturing Company has on exhibition one of its express pumps direct connected to a one-horsepower, 110-volt, sixty-cycle, alternating-current repulsion motor. The following representatives have charge of the exhibit: A. L. Pond, assistant manager Chicago office; L. A. Carr, A. J. Francis, H. Plumley and A. E. Stevens, agents.

The General Acoustic Company, Chicago, Ill., is exhibiting its line of instruments for the deaf, including the Acousticon, showing by demonstration its adaptability for use in theaters, churches, etc. C. S. Saxton is in charge.

The General Electric Company's exhibit is of unusual interest. The line of heating devices is very complete, consisting of coffee percolators, toasters, tea kettles, flat irons, chafing dishes, water heaters, luminous radiators, cigar lighters, etc. The small motor exhibit consists of alternating and direct-current fan motors, fractional horsepower mo-

tors, a motor-driven sewing machine, and an electrically-driven breast drill. The lamp exhibit is very complete. The booth is lighted by "G. E. Mazda Lamps," sixteen twenty-five watt, twelve sixty-watt, and eight 150-watt lamps being used for this purpose. There is on exhibition three ornamental intensified arc lamps, one nine-ampere luminous arc lamp, two twelve-ampere and two eighteen ampere arc lamps, a brass arc illuminated by "G. E. Mazda" and tantalum lamps of different sizes and capacities, two lamp cabinets displaying a complete line of miniature lamps and a photometer for showing comparative tests of "G. E. Mazda" and carbon lamps. There is also a complete line of cabinet panels and wiring devices.

The General Vehicle Company, Long Island City, N. Y., is showing a 1,000-pound delivery wagon and a two-ton truck, also photographs of various carrying capacity vehicles in actual commission throughout the country. The two-ton truck is jacked up and the wheels running by its own power. The representatives in attendance are P. C. Chrysler, western manager, R. W. Maginnis, Ezra Martin and J. J. Cuff.

G. M. Gest is making a striking exhibit, showing a full-sized section of a man-hole, illustrating the method of introducing fibre conduit and clay conduit. The cable splicing and cable runs and brick work show how fine an art conduit construction has become under Mr. Gest's improved methods. The New York Reinforcing Pole Company is also making an exhibit here of its concrete reinforcing system for rehabilitating weaking poles. The booth is in charge of J. A. Doyle and W. T. Jackson.

The Grand Ledge Clay Products Company occupies part of the space of the Manhattan Electric Supply Company, and is exhibiting a number of clay products and other products.

The Hahl Automatic Clock Company, Chicago, Ill., has on exhibition an automatic clock system consisting of a master clock which operates any number of secondary clocks within a building or group of buildings; an automatic clock and program system in which the master clock may be equipped with program apparatus and thus control and operate both clocks and signals, and also a switchboard and push button board which enables the ready changing of signals from one circuit to another and the ringing of each individual bell by hand. The company is represented by H. H. Gross, L. B. Montgomery, P. J. Herts, H. R. Mendius and Carl Mendius.

The Hamler-Eddy Smoke Recorder Company, Chicago, Ill., has on exhibition the Eddy Automatic Smoke Recorder, which instrument is the means of keeping account of the efficiency of a smokeless furnace equipment by recording on a chart whenever smoke is flowing from a stack. The exhibition is in charge of R. L. Eddy.

The Hinde & Dauch Paper Company, Sandusky, Ohio, is exhibiting corrugated fibre board packages, specially designed for shipment, either by freight or express, of fragile or lightweight articles. At this exhibit special attention is given to packages designed for shipping carbon and tungsten lamps. The exhibit is in chare of D. A. Larkin, who is assisted by the Chicago representative of the company, E. J. Elserman.

The Hoskins Manufacturing Company of Detroit has on exhibition its type FA, FB and FC electric furnaces; different sizes and forms of the first two are operated; its electric hot-plates of different forms, sizes and for different uses in connection with a variety of laboratory work; its electric pyrometers for determining high temperatures by means of thermo-electric currents A permanent installation of these pyrometers in actual work is shown. Also the Hoskins soldering irons and the "Cherrie" toastove. The company is represented by H. Ralph Badger, W. V. Young, C. F. Busse A, S. Lee.

The Hoover Suction Sweeper Company, New Berlin, Ohio, has on exhibition its sweeper which combines the features of a carpet sweeper and vacuum cleaner. These machines are demonstrated by a corps of operators who explain the merits of this cleaner. The exhibition is in charge of W. D. Elatener and A. C. Griswold.

The Houston Manufacturing Company, Rockford, Ill., has on exhibition a vacuum cleaning plant suitable for use in residences, churches, small hotels, offices, clubs etc. of one sweeper capacity. The company is represented by F. K. Houston or W. S. Sutton and H. A. Kirkby.

The Hurley Machine Company has an attractive booth in which the merits of the Thor electric washing machines are demonstrated and explained by a corps of competent operators.

The Illinois Appliance Company, Chicago, Ill., demonstrates by removing and installing incandescent lamps of various sizes the value of its lamp changers. The exhibition is in charge of J. G. White.

The Electric Heated Garment Company, Chicago, Ill., is making a display of electric-heated garments, which are recommended as suitable for persons suffering with rheumatism.

The Judd Laundry Machine Company has on exhibition its line of electric family laundry machines. These machines are in operation and the feature of the exhibit is its new electric washing machine. Ira M. Smith, president and general manager; Henry S. Judd, vice-president and treasurer, and Charles U. Beach, sales manager, with several salesmen and demonstrators, are in attendance at the show.

Mathias Klein & Sons, Chicago, Ill., have an attractive booth, in which is displayed a complete line of electricians' and mechanics' tools and implements. There is also exhibited various insulating material, including tape, glass and porcelain insulators. There is also exhibited the Wasson double-reel special pliers and electricians' torches. The exhibit is in charge of J. M. Klein, Jr., and Paul Herbst.

The Kimble Electric Company, Chicago, Ill., has on exhibition its regular line of variable speed, single-phase, alternating-current motors, in sizes from one-eighth to one and one-half horsepower. Among these is a motor operating a church organ, and a motor operating a printing press, also four ventilating fans of the following sizes: Eighteen, twenty-four, thirty and thirty-six-inch; a one-eighth, one-fourth and one-half-horsepower forge blower. There is also shown a new line of three-phase induction motors. The following representatives are in attendance at the exhibit: Austin Kimble, R. P. Warner, H. A. Seaton, Ray High, Jas. K. Bass, G. L. Holzheimer, Roy Gilburg and Carl Healy.

The Keller Manufacturing Company, Philadelphia, Pa., has on exhibition a complete motor-driven stationary vacuum cleaning plant as adapted for hotels, office buildings, etc. "Santo" portable vacuum cleaners are also exhibited and subjected to severe tests by the demonstraters. Julius Keller, Philadelphia, Pa., has charge of the exhibit and is assisted by Chas. Strader & Company, the western distributers for the company, the latter being represented by Chas. Strader, Geo. F. Duff and A. J. Saunders.

Chas. L. Kiewert Company, Milwaukee, Wis., has an attractive booth in which it is exhibiting the well-known Alba, Aurola, Trucolor and Economy arc lamps. A feature of the exhibit of this company is a specially fitted booth made to represent a show window of a store, and equipped with a Trucolor arc lamp to demonstrate the efficiency and quality of light obtainable from this type of lamp. The booth contains men's furnishing goods supplied by the Washington Shirt Company, of various colors, thus giving the lamp a severe test. This company has also installed twelve Alba flaming arc lamps on the exterior of the building. R. W. Kiewert, K. A. Albrecht and H. W. Fowzer are in attendance.

The Long Beach Electric Manufacturing Company, Long Beach, Cal., is exhibiting a new type of fuse, known as the "Tidmarsh Recharging Enclosed Fuse," which is made in all sizes and will fit all cut-out locks that comply with the dimensions specified by the National code. W. H. Tidmarsh, president of the company, is in charge of the exhibit.

The Manhattan Electrical Supply Company, Chicago, Ill., is exhibiting complete equipment necessary for the construction of wireless telegraph outfits. A feature of this exhibition is the installation of a wireless outfit from which messages are received and transmitted to other stations installed in the building. There is also displayed dry batteries, induction coils, switches, etc. N. Richmond and E. H. Lewis are in attendance.

The Macbeth-Evans Glass Company, Pittsburg, Pa., has an elaborate display of glassware, including Alba and tungsten reflectors, Bornique art glass shades and a complete line of Macbeth goods and a number of portable lamps. A feature of this exhibition is a structural Alba glass which is used for decorative purposes. The exhibit is in charge of F. M. Young and A. C. Kay.

The Milwaukee Vacuum Machinery Company, Milwaukee, Wis., is exhibiting a line of portable electric vacuum cleaners. The exhibit is in charge of Mr. S. M. Sutherland.

The Shaw Automobile Company, Chicago, Ill., has on exhibition a Columbus four-passenger electric vehicle which is demonstrated by W. H. Farrington.

The North Shore Electric Company, Chicago, Ill., is demonstrating the various applications of electricity, particularly those as are interesting to householders. Electrically-operated washing machines, sewing machines, meat choppers, coffee grinders and pumps are demonstrated and explained. An interesting feature of this exhibit is a switchboard equipped with meters showing the comparative current consumption of various types of lamps.

The National Electric Lamp Association shows a complete line of 110 and 220-volt regular tungsten lamps, "Mazda Brand"; regular 110 and 220-volt tantalum lamps, tantalum street car lamps, tungsten street series lamps, "Mazda Brand"; sign lamps and miniatures. Part of the lamps are shown burning on racks and the remaining portion are exhibited in glass show-cases, etc. Special booth lighting is afforded by thirteen single unit fixtures, placed on the columns around the booth and six bracket street series fixtures placed on the center columns. A feature of the exhibit is a device consisting of a box of wood and cloth, in which three mirrors and a lamp are mounted in such a manner that by revolving the box about a horizontal axis the intensity of light at any angle in a vertical plane through the lamp may be observed. Another feature shows the "balance position" of a Bunsen photometer screen for a 100-watt tungsten "Mazda Brand" lamp and a 100-watt carbon lamp. Two indicating wattmeters show the equal consumption of power. The position of the photometer screen indicates the increased light intensity from the Mazda lamp over that of the carbon. On this same exhibit is a belt sign that moves from right to left at a speed sufficiently slow to permit the reading of the sign. The following representatives are in attendance: J. B. Crouse, H. M. Vanzwoll, S. E. Doane, W. M. Skiff, P. S. Dodd, P. F. Bauder, H. S. Hall, J. D. Holt, A. J. Hitzker and C. O. Brandel.

The National Acme Manufacturing Company, Cleveland, Ohio, has on display one of its individual motor-driven, automatic screw machines and other products of the company. E. C. Woolgar is in charge.

The Nohe Electric Renovater Company, Chicago, Ill., has on exhibition its electric vacuum cleaner which is shown in actual operation. I. A. and A. W. Nohe are in attendance.

The Neville Illuminating Sign Company, Chicago, Ill., is making a comprehensive display of various types of electric signs. C. A. Neville, T. R. Gratton, A. F. German and F. Gilbert are in attendance.

The National Carbon Company, Cleveland, Ohio, has on exhibition a full line of lighting carbons for open and enclosed lamps of all kinds, flame lighting carbons, projector and moving picture carbons, smelting electrodes, electro-chemical electrodes, carbon brushes of various grades, and a complete line of Columbia and Columbia igniter dry cells. Also the new multiple battery designed for ignition work and a complete line of flashlight and novelty batteries. The exhibit covers standard carbons and electrodes running from a few grains in weight to more than 1,000 pounds. Wallace O'Connor, A. G. Summerell, R. A. Crider, A. V. Ward, H. A. Worman and E. H. King are in attendance.

Henry Newgard & Company, Chicago, Ill., has an attractive exhibit which consists of a seven-panel power switchboard complete in all of its details. This board is for an actual installation, and contains all of the instruments, switches, etc., necessary for an installation, including all switchboard wiring. The booth is in charge of F. G. Smith.

The National Electric Specialty Company, Toledo, Ohio, is exhibiting "Ritetite" self-soldering wire joints, self-soldering duplex cartridges, V. A. C. lightning arresters, and other of its specialties. F. S. Chapman, electrical engineer, is in charge of the exhibition.

The Oral and Motion Manufacturing Company, Chicago, Ill., is demonstrating the mechanical operation of an electrically illuminated and operated advertising device which consecutively presents moving posters or display cards of different colors and subject matter, and which by a new mechanical combination talks, in a Himan voice, about the goods or advertisements displayed. Other transparencies and illuminated signs are shown. L. S. Treat, sales manager, is in charge, assisted by members of the Chicago force.

The Pacific Electric Heating Company, Ontario, Cal., has on exhibition its automatic type electric irons, which bear the inspection stamp of the National Board of Fire Underwriters. There are six different sizes of these irons shown. There is also on exhibition an electric iron claimed to be the smallest manufactured, weighing two and one-half pounds. This iron is shown with a stand for reversing the iron to use it for cooking purposes. This company is also displaying a new design of household iron and an extensive line of other electric heating and cooking devices. H. F. Holland, Chicago manager, is in charge.

The Pelouze Electric Heater Company has a very attractive exhibit, showing in addition to the well-known Pelouze electric irons, several household heating devices which promise to prove very popular. Among the new articles shown are included a disc heater, made in three sizes, a tea kettle, frying pan, a novel coffee extractor, a tea samavor, a water heater or liquid cooker and a new combination stove-toaster and griddle. All of these articles, with the exception of the Pelouze stove-toaster, depend upon a round heating unit which is complete in itself and separate from the vessel, in the same manner as the units used in their sad irons. The booth is in charge of Col. W. N. Pelouze and A. A. Guardin.

The Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., has on exhibition a complete line of telephones for all kinds of service, including the new automatic key type inter-communicating telephones, both flush type and standard. It also exhibited telephones for use in mines and on railroad dispatching systems, together with its selective dispatcher's signal. Several types of switchboards with standard equipment, both magneto and central energy, are shown. A. M. Haubrich, Chicago manager, is in charge of the exhibit and is assisted by Messrs. Cannon, Stigberg and Lewis from the Chicago office and Paul D. Myers, Illinois representative, and E. P. Shafer, Indiana representative. H. C. Siemin, sales and advertising manager for the company, is in attendance part of the time.

The Stromberg Electric Manufacturing Company, Chicago, Ill., is exhibiting a Stromberg electric chronograph, an electrically-operated time recorder adapted for registering employes in-and-out; also for factory time-cost keeping, using job or daily time cards; and for general office purposes. The system uses one master clock, which controls electric current for any number of chronographs, thus insuring absolute uniform time throughout, adapted for every field of time recording. The company is represented by A. Stromberg, H. A. Jones, B. Pedersen, A. L. Denniston, W. R. Blake and F. G. Kauffman.

The Shelton Electric Company, Chicago, Ill., is showing a complete set of its vibrators and electric hair-drying machines. W. G. Shelton, president, and J. M. Peacock, Chicago manager, are in charge of the exhibit.

The Schneible Company, Buffalo, N. Y., features in its exhibit centrifugal pumps and speed reducing devices. There is also shown a two-stage, high-pressure, high-efficiency, electrically-driven centrifugal pump in operation, and also electrically-driven speed reducing devices. Representatives in attendance are J. Schneible, E. Zahm, H. E. La Bour and W. C. Braun.

The Simplex Electric Heating Company has on exhibition a complete line of heating devices. The special features are three complete different sizes of electric ranges and an exhibition of practical ironing by means of the electric iron. There are four operators present. Among the devices which are exhibited this year which have come out since the last show are the electric toasters for domestic and hotel use, as well as several new models of irons, chafing dishes, percolators, etc. The following are in attendance: H. R. Hixson, J. N. Macalister, J. G. Brobeck, W. F. Hruby, Geo. W. Plachek and E. R. Jacobs.

The Jewell Electric Company, Chicago, Ill., is exhibiting a number of storage batteries for ignition, electric light and power. There is also shown the Haschke carbon point connected to storage batteries, which discharge at the rate of 125 horsepower, concentrated to the point of the carbon rod, which perforates half-inch holes in a sheet of five-ply steel. J. E. Haschke is in charge of the exhibition.

The Perfection Vacuum Cleaner Company, Chicago, Ill., has on exhibition in its booth a stationary vacuum cleaning plant as adapted for use in residences, and also a large plant for use in schools, hotels, hospitals, etc. Harvey Wallace, C. E. Wall and C. J. Becker are in attendance.

The Sefton Manufacturing Company, Chicago, Ill., has on exhibition an attractive display of paper packing and shipping boxes. An interesting feature of this exhibition is the corrugated paper packing box for tungsten lamps. W. H. Fairchild, J. P. Brunt, Richard Ferguson and Ellis Woodworth are representatives at the exhibition.

The Stolz Electrophone Company, Chicago, Ill., has an attractive booth, in which is exhibited the Stolz Electrophone, a device which improves the natural hearing. This device is demonstrated and subjected to various tests by the operators. J. S. Linde is in charge of the exhibition.

The Studebaker Automobile Company, Chicago, exhibited its four-passenger electric vehicles. W. G. Palmer is in charge of the exhibit.

The Swedish Vibrator Company, Chicago, Ill., is exhibiting a line of electric vibrators which are used to give free massages to the visitors.

The Swedish-American Telephone Company, Chicago, Ill., has on exhibition complete equipments for magneto exchanges. Also private branch exchange switches, inter-communicating telephone sets, batteries and other telephone specialties. There is also shown a number of radio adjustable, ball-bearing telephone holders and the various uses of these are explained by W. O. Rhode and W. E. McCormick, assisted by members of the sales force.

The Temple Automobile Company, Chicago, Ill., has on exhibition a Baker electric and also a chasis of one of these machines showing the new double-gear shaft drive. Ralph Temple is in charge of the exhibit, assisted by F. G. Briggs.

Thompson Brothers Company, Grinnell, Iowa, has on exhibition its well-known Elmo electric washing machine, the advantages of which are being demonstrated by actual work. M. A. Ayer is in charge of the exhibit.

The United States Light and Heating Company, Chicago, has on exhibition all types of storage battery plates for light and power, propulsion, ignition and automobile lighting, in addition a plate recently developed for electric car lighting purposes. The Bliss and Moskowitz car lighting systems are also shown in detail. The following representatives are present: J. Allen Smith, Bertram Smith, W. M. Lalor, A. O. Hiester, W. L. Bliss and W. F. Bauer, sales engineer, Chicago.

The Vulcan Electric Heating Company, Chicago, Ill., has an interesting exhibit on account of the demonstrations made. These are all of practical value, as the Vulcan devices are shown working under severe service conditions. The "Electrocurl" is being demonstrated by an expert hair dresser, and any lady so desiring may have her hair dressed in becoming style free of charge. Vulcan "Electric High Temperature Soldering Tools" are being used on work of all kinds, both in their own booth and in that of the Commonwealth Edison Company. "Electric Marking Pencils" are shown for marking shipping cases, boxes, etc. Red hot "Electric Branders" for wood, meat, leather, rubber and other materials are also shown in various styles and sizes, both as hand and power tools, and souvenirs are made on the spot with them. H. H. Russell is in charge of the exhibit and F. J. Holmes, president, G. W. Cravens, general manager, and other officers of the company are also present.

The Western Electric Company is making special efforts to educate the public to the simplicity and usefulness of the inter-phone system. To this end it has connected up several sets and demonstrates every feature of them in its booth. The simplicity and ease of installation and readiness with which they can be brought into use at all times of the day or night is brought out in a striking manner. "Hawthorn" fan motors of the eight, twelve and fifteen-inch sizes are displayed to good advantage. "Hawthorn" and Faraday bells are exhibited. Two "Hawthorn" flaming arc lamps are displayed and particular attention called to the interior construction, the noticeable absence of complicated mechanism, the parallel carbon design and the gravity feed arrangement. Miscellaneous house goods of various kinds are displayed in quantity and advertising material to the effect that the Western Electric Company furnishes equipment for every electrical need. The men in charge of the exhibit are F. A. Ketcham, H. L. Grant and others.

The Westinghouse Electric and Manufacturing Company of Pittsburg, Pa., displays

very complete line of its smaller apparatus, particularly that for domestic service. The coffee percolator, chafing dish, and other heating devices are shown all in service preparing coffee, welsh rarebit and other dainties for the many visitors. The instantaneous water heater is also exhibited. The utility of this device is also demonstrated by the attachment of a small device which fitted it for poaching eggs in a most expeditious manner. In addition to these new heating devices there are shown flatirons of various sizes, tailor irons, electric glue pots, chocolate warmers, luminous and non-luminous radiators. In small motors are displayed an entire line of buffing motors for jewelers and dentists, with all the necessary attachments for grinding and polishing and a number of small power motors for both alternating and direct current; also several different types of fan motors. In the exhibit is shown a representative line of both alternating-current and direct-current motors for industrial service, for both constant and intermittent service, with controllers and rheostats for control of same, and one of its smallest unit switch controllers, complete with master switch, in operation. A mercury rectifier charging outfit is shown, connected to an automobile charging panel and operating under load conditions. The Westinghouse Lamp Company exhibits a representative line of its 110 and 220-volt tungsten lamps; also its low-voltage tungsten lamps for general illumination and signs. Among those present in attendance at the exhibit are the following: T. P. Gaylord, W. R. Pinckard, R. Everson, M. McNeil, A. L. Millard, E. M. Bischoff, S. Gardener, R. H. Morre, Chas. Talbot, J. W. Busch, C. W. Regester and W. Barnes, Jr.

The Wizard Washer Company, Chicago, Ill., has on exhibition its Wizard electric washing and wringing machine, which is shown in actual operation. The company is represented by R. J. Killick and D. J. Kennedy.

Postal Telegraph Company to Lose Its Identity.

The Postal Telegraph-Cable Company is about to lose its old corporate name at least, if not its entire identity, by the filing of a petition in the New York Supreme Court on January 14. The petition was filed by Charles C. Adams, vice-president of the Postal Company, and sought to have the name of the company changed to the Transcontinental Telegraph Company. Incidentally the petition disclosed the fact that the Postal Company has not been in the overland telegraph business for several years. Mr. Adams stated that the company had disposed of its telegraph business to the New England Telephone and Telegraph Company, which has continued the business under the name of the Postal. The petition was granted.

In many circles it is believed that this move verifies the assertions made two months ago, when the American Telephone and Telegraph Company secured practically a controlling interest in the Western Union Telegraph Company. It was stated that the American Co. controlled the trunk telephone and telegraph systems of the country.

Tenth National Automobile Show, New York City.

The automobile show which closed its week in Madison Square Garden, New York city, on January 15th, was indeed a big show in every sense. More space in the garden was utilized than ever before, the main floor, the balcony, the basement and even the dining hall were required to care for the 354 exhibitors.

The decorations were planned to represent a Roman amphitheatre, in white and gold, with sky-blue bunting in the ceiling. The regular lighting was reinforced by twenty-eight flaming arc lamps. It can be seen that the statement that no expense was spared to make the show a delight to the eye was correct, when the amount reached some $35,000. This would seem to be justified when one considers that nearly 150,000 persons attended. There were forty-two exhibits of American pleasure cars and of these ten were electrics, the latter all being shown in one room. Among those exhibited were the General Vehicle, Baker, Woods, Studebaker, Bailey, Waverly, Detroit, Columbia, Babcock and Rauch & Lang.

The commercial vehicles were all exhibited in the basement, and of the twelve American cars three were electrics, made by the General Vehicle Company, Baker Motor Vehicle Company and the Studebaker Company.

Among the features of the show were the illuminated lanterns, eighty being upon posts giving the name of the exhibitor. These lanterns were square with panes of ground glass, the name being in red letters.

The exhibit of the Baker Company was marked by elegance and luxuriance, the appointments being particularly ornate. There was a four-passenger coupé finished in black, striped with gold, upholstered in golden bronze, brocaded satin, trimmed with broad lace, with tufted satin headlining and silk window shades and draperies. This was equipped with a Holophane dome light, cut glass flower vase, and the controller handle and metal parts were gold mounted.

The victoria-phaeton exhibited by the Waverley Company, and which might be converted into either a brougham or coupé, attracted a great deal of attention.

The feature of the Woods exhibit was a new type of brougham. This car seats five persons, has a wheel base of eighty-six inches and a gauge of fifty-six inches, and is equipped with the Woods four-pole series motor with a selective forward and reverse in one handle.

The Bailey victoria showed several changes since last season. A wheel steer has been installed in place of the lever type and a foot brake-lock has also been made a part of the equipment.

The Mark 75 victoria-phaeton was a feature of the Columbia exhibit. This car has a pressed steel frame, double chain drive, and a six-speed controller. The body can be removed by extracting four bolts and the car converted into a coupé or a landaulet.

The fast running, high-geared victorias were the feature of the Babcock exhibit.

A victoria-phaeton with a basket body, a two-passenger coupé, a landaulet and a roadster made up the Studebaker exhibit.

The General Vehicle Company made a striking exhibit of its electric truck, showing a powerful chassis and driving gear, and distributing some very interesting data indicating the superiority of the electric vehicle for commercial delivery work.

Stanley Plant Will Be Enlarged.

The General Electric Company has plans prepared for the big pattern storage building it is to erect at the Stanley plant, and the contract will be awarded within a short time. The building will cost between $60,000 and $100,000. It is estimated that the company will expend about $600,000 in new buildings at the Stanley plant this year, which will surpass the amount expended in any previous year on buildings. The amount of business done at the plant amounts to $1,000,000 a month.

Holding Company Favored.

A law permitting the Boston Elevated Railway to hold stock in other street railway companies through the incorporation of the Boston Railway Holding Company, is recommended by the joint Board of Railroad and Boston Transit Commissioners, in a report to the Massachusetts Legislature.

The joint commission reports against numerous propositions for tunnels and additional subways in the city of Boston, although a subway connecting the Park street subway station with the South Terminal station is favored.

Fortieth Annual Meeting and Dinner of the Western Society of Engineers.

The fortieth annual meting and dinner of the Western Society of Engineers, held in College Hall, University Club, of Chicago, Wednesday evening, January 12, emphasized clearly the remarkable growth of this society both in members and character.

Following a very enjoyable menu, Retiring-president Andrews Allen delivered a brief address covering the history of the society, emphasizing its growth and explaining its scope and the benefits derived by its members.

This was followed by the introduction of President-elect John W. Alvord, who in a brief manner outlined the future work to be accomplished and also made several important recommendations, chief of which was one asking for a larger number of members engaged in municipal engineering.

At the conclusion of Mr. Alvord's talk, Bernard E. Sunny, president of the Chicago Telephone Company, was introduced, and delivered a very interesting and instructive address on the subject of "The Engineering of Chicago."

There are eight vital engineering problems, each affecting the future welfare and development of Chicago, which Mr. Sunny discussed in the course of his address, namely: a new sewer system; a high-pressure water system; steam railway terminals to suit city's condition; rebuilt pavements in the business district; "Lakes to the Gulf" deep waterway; harbors; subways, and the Chicago plan of the Commercial Club. The two fundamental requirements for securing these improvements, Mr. Sunny said, are first a comprehensive and complete plan of all municipal works for the longest period practicable, and second legislation and finance.

The sewer system in the downtown district, according to the speaker, is inadequate to meet the present needs, and a system three times the size of the present one was recommended. Mr. Sunny cited specific instances where after a moderate rainfall, overflows causing much damage resulted. Sewer connections to the various buildings downtown were also pronounced inefficient.

Regarding a high-pressure water system, Mr. Sunny referred to similar systems installed in a number of large cities and dealt at some length with the success of these systems. He said that it has been found from experience that high-pressure water systems are more desirable in outlying districts for the reason that practically all of the larger buildings in the downtown district are of fireproof construction. By way of emphasizing this recommendation it was shown that aside from the safety such a system would afford, the saving in insurance premiums would more than warrant its installation.

The plan of President Delano of the Wabash Railroad covering steam railroad terminals for Chicago, was commended by Mr. Sunny who heartily agrees with the plan in every respect. This system, an account of which appeared in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of September 25, 1909, recommends a group of stations near Twelfth Street, and one on the west side of the river.

The problem of rebuilding pavements in the business district was dealt with briefly, because several of the principal streets already have improved pavements, and it is understood that plans are now under way to extend this throughout many more of the streets.

The "Lakes to the Gulf" deep waterway was mentioned as one of the principal engineering feats to be accomplished by this community. A good start has already been made in the form of the Drainage Canal from the Chicago River to Lockport, Ill., and the people of Illinois have authorized a $20,000,000 bond issue to continue this work to St. Louis. From there on the proposition rests with the United States Government to deepen the channel of the Mississippi River to the Gulf. The benefits resulting from this deep waterway system were mentioned, and statistics given which demonstrated that, considering the cost, the investment would be exceptionally good.

Mr. Sunny outlined a comprehensive plan for a complete harbor system. He suggested the widening of the Chicago River, replacing of many bridges, straightening of the channel of the river from Twelfth to Sixteenth streets, illuminating the river by electricity, and eventually reserving the lake front for future harbors.

The subway plan evoked considerable interest, as this question is one that is constantly before the minds of the people of Chicago. Mr. Sunny said that for years the business district has been regarded as the terminus of all transportation lines, and some of the subway plans thus far submitted perpetuate this idea in planning loops in this district. Taking as an example the present elevated loop, which has justly been severely criticised for many years, it seemed to Mr. Sunny that a loop subway plan was indeed faulty. He suggested a plan, however, which is well worth considering, namely, a four-track subway in State Street from Twelfth Street to Indiana Street on the North Side for surface lines; a three-track subway in Dearborn Street from about Twelfth Street to Chicago Avenue, and in Chicago Avenue to North Franklin Street for elevated service; a four-track subway in Clark Street from Twelfth Street to Ohio Street on the North Side, for surface lines.

The Chicago plan of the Commercial Club was highly commended by Mr. Sunny, who outlined the various improvements contemplated, among which may be mentioned the widening of many of the streets, the extension of the boulevard systems, and in general the entire beautifying of the city.

In conclusion the speaker strongly urged that the city be supplied with a board of high class engineers to whom shall be referred all data on the property now owned by the city, and all suggestions that have been made with respect to improvements. An engineering board made up of specialists in the several lines such as subways, water, sewerage, railways, harbors, etc., in a brief time would make a definite and undoubtedly satisfactory recommendation with reference to all important improvements.

E. H. Fritch, chief engineer, Chicago Great Western Railway, was called upon and briefly referred to the freight traffic which he considers of great importance to the city. The problem of electrifying the railroads was brought in, and although Mr. Fritch refused to commit himself, he said that electrification would undoubtedly come and the sooner the problem was considered the better off the railroads would be.

Bion J. Arnold, being present, was called upon for his views on the transportation problems recommended by Mr. Sunny, and while refusing to enter a discussion said that he did not entirely approve of Mr. Sunny's subway plans, but thought the suggestions made therein were good.

Decisions Affecting Foreign Corporations in Illinois.

Attention has been called by Frederic P. Vose, Marquette Building, Chicago, to three important decisions handed down by the Appellate Court, First District of Illinois, on December 23, 1909, affecting foreign corporations doing business in Illinois.

The first was that of the Frank Simpson Fruit Company vs. the Atchison, Topeka and Santa Fe Railway Company, holding in effect that the mere commencement of an action in any one of the Courts in Illinois is the exercise of corporate power in Illinois. A foreign corporation which is not qualified to do business in Illinois by complying with the terms of Chapter 32 of the Revised Statutes, entitled "An Act to Regulate the Admission of Foreign Corporations for Profit to do Business in the State of Illinois," subjects itself to the prohibition found in the Act and is debarred from maintaining its suit in the Illinois Courts. Such a corporation, lacking the right to institute a suit, when it does so in violation of this prohibitory statute, the tribunal, whose jurisdiction is thus invoked, is without power to grant relief or to take cognizance of such suit or to render the judgment sought.

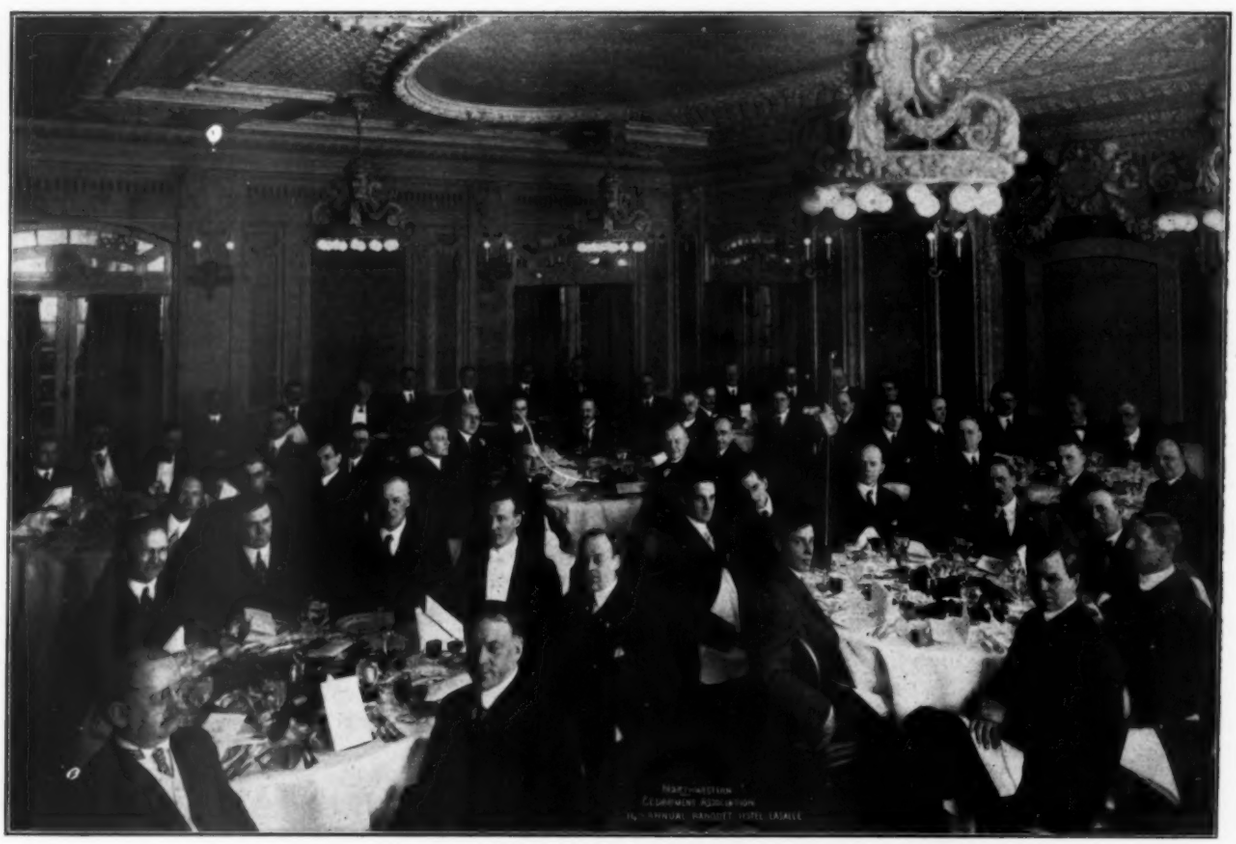
The second suit was that of the Erie and Michigan Railway and Navigation Company vs. The Central Railway Equipment Company, which, in effect, held that a foreign corporation never authorized to transact business in Illinois and to sue and defend in its courts, cannot maintain a suit for relief from the consequences of a contract made in Illinois, which it had then no power to make and upon which it had not then the right to maintain any action, either at law or in equity, in the courts of Illinois.

To the same effect is the decision in the case of the United States Gypsum Company vs. The Central Railway Equipment Company, decided the same day, which held that where a corporation undertakes to guarantee the full performance of a contract entered into by an unlicensed foreign corporation in Illinois, exercising its corporate powers in Illinois in violation of this law, such guarantee is without effect and void.

Northwestern Cedarmen's Association Convention.

The Northwestern Cedarmen's Association held its annual convention at the Hotel La Salle, Chicago, on January 11 and 12 last.

President E. L. Clark called the first session to order at 11:00 a.m. on Tuesday morning, and took for the subject of his inaugural address the present conditions in the pole industry. He took a hopeful view of the situation and predicted at least a living range of prices for 1910. The late despondent markets were due to various causes, among which was the fact that the inactivity on the part of the larger consumers had robbed the pole men of a competitive buying market on the part of the small consumers, with the result that there was no trade to speak of. He drew attention to the fact that the production this winter would be less than one-half of what it was last winter, and that non-members of the Association had practically no stocks on hand. He ventured to opine that the demand for the season of 1910 would be above normal, and that prices



NORTHWESTERN CEDARMEN'S ASSOCIATION BANQUET AT HOTEL LA SALLE.

would be unusually good. He advised his hearers to hold on to their stocks if they would realize the best prices. He suggested that members advise the secretary of the Association from time to time of the amount of their holdings, to enable co-operation with the other members properly to be effected.

After the president's address was formally accepted, Secretary H. H. McKinney proceded to read his annual report. He reviewed the work of M. C. Nelson, who had held the office of secretary during the first part of the year (he himself had been in office about three and one-half months), and said that the most important part of this was the issuance of the freight-rate book, with Rexton, Mich., as a basis. Tariffs had changed materially, however, during the last three months, necessitating considerable changes in the book. A correction sheet covering the changes up to December 1 had been issued on that date. Among other interesting parts of the secretary's report was the fact that that the membership of the Association numbered thirty-two.

The report of the treasurer (W. B. Thomas) showed a balance, on January 11, 1910, of $1,206.63.

The reading and discussion of the report of the committee on the freight-rate board concluded the morning session.

On Tuesday evening a very enjoyable banquet at the Hotel La Salle was attended by nearly all the member companies' representatives, and by a number of invited guests. Among those present were the following:

E. L. Clark, Valentine-Clark Company, Chicago; H. H. McKinney, Secretary, Minneapolis, Minn.; Wm. Mueller, Wisconsin Land and Lumber Company, Hermansville, Mich.; T. M. and H. F. Partridge, T. M. Partridge Lumber Company, Minneapolis, Minn.; J. W. Benham, A. T. Naugle and Joe Naugle, Naugle Pole and Tie Company, Chicago; M. H. Coolidge, Coolidge-Schussler Company, Minneapolis, Minn.; W. B. Thomas, White Marble Lime Company, Manistique, Mich.; M. McLeod, Bay de Noquet Company, Nahma, Mich.; Hall L. Brooks, Hall L. Brooks Company, Tomahawk, Wis.; M. K. Bissell, Erickson & Bissell, Escanaba, Mich.; T. P. Bradley, Duluth Log Company, Duluth, Minn.; H. M. Dixon, Cloquet Tie and Post Company, Cloquet, Minn.; L. A. Page, Page & Hill Company, Minneapolis, Minn.; W. C. Moss, McCulloch & Moss Lumber Company, Minneapolis, Minn.; H. S. Gilkey, Pendelton & Gilkey, Minneapolis, Minn.; W. S. Patch, Crawford Cedar Company, Menominee, Mich.; J. E. Gerich, MacGillis & Gibbs Company, Milwaukee, Wis.; J. C. Kirkpatrick and H. W. Reade, National Pole Company, Escanaba, Mich.; C. H. Worcester, C. H. Worcester Company, Chicago; W. T. Watkins, Deer River Lumber Company, Chicago; R. A. Griffin, Western Electric Company, New York city; W. P. Bowring, C. H. Worcester Company, Chicago; E. C. Norton, Kellogg Switchboard and Supply Company, Escanaba, Mich.; J. C. Kenny, Western Electric Company, Chicago; Edward B. Ellicott, Electrical Engineer, Sanitary District, Chicago; T. W. Stromberg and H. H. Sperry, Kellogg Switchboard and Supply Company, Chicago.

The Wednesday morning session was devoted chiefly to the election of officers. The following were elected:

President, T. M. Partridge; vice-president, J. E. Gerich; treasurer, W. B. Thomas; directors, H. S. Gilkey (for one year), E. L. Clark (for two years), L. A. Page, Jr. (for three years).

Thomas M. Partridge, the new president, was born at Rochester, N. Y., December 31, 1865. His early education was acquired in the graded schools of that city, after which he attended Hobart College, at Geneva, N. Y. He came west in 1886, and has been connected with the lumber business in various capacities since.

T. M. PARTRIDGE.

In 1900 "T. M.," with his brother, H. F. Partridge, started in business in Minneapolis, Minn., under the firm name of the T. M. Partridge Lumber Company. The company was incorporated the same year, with T. M. Partridge president, and H. F. Partridge secretary and treasurer. The company handles white cedar poducts in large quantities, of its own production.

T. M. Partridge is also president of the Partridge-Dyer Lumber Company, with headquarters at Baudette, Minn., on the Canadian Northern Railway, from which point it handles business for the Canadian Northwest. He is also president of the Denniston & Partridge Company, retail lumber dealers, with headquarters at Newton, Iowa, and operating a line of retail lumber yards in that section of Iowa.

Chicago Electric Club.

Following the regular mid-day luncheon of the Chicago Electric Club on Wednesday, January 12, George Keech, of the Cooper Hewitt Electric Company, addressed the club on the subject of "Mercury Vapor Lamps."

Mr. Keech explained the various types of mercury vápor lamps in existence and the developments of each type. The phenomena of passing current through mercury vapor has been known since 1860, but up to 1892 no successful lamp had been placed on the market of this type. Shortly after this year, however, Mr. Hewitt brought into commercial use the Cooper Hewitt mercury vapor lamp.

By means of these lamps which Mr. Keech had temporarily installed he explained in detail their operation. He also demonstrated the operation of the older type of this lamp consisting of a long glass tube, exhausted with air and containing a little mercury. The current is started by a spark at the surface of the mercury and flows through the mercury vapor in the tube, rendering it incandescent and giving it a greenish light. The light contains almost no red rays, so that objects appear to change color when viewed by it.

Regarding the color, Mr. Keech said that while for some uses the lamp has not met with much favor on account of the color of the light, there are, however, many large installations which demonstrate its peculiar qualities. The speaker referred to installations in printing offices, machine shops, photograph galleries, postoffices and factories, and named the advantages of this type of lamp.

Toledo Electrical Show.

A feature of the electrical show to be held at the Coliseum in Toledo, January 31 to February 5 will be a mammoth baking contest given to test the merits of the large number of electrical appliances, heaters, cookers, and stoves which will be on display. Expert demonstrators representing the various manufacturers will conduct the contest. The bread and other food stuffs turned out will be given to charity. Prominent Toledo bakers will act as judges. H.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

242D MEETING AT NEW YORK, JANUARY 14, 1910.

The 242d meeting of the American Institute of Electrical Engineers was held at the Engineering Societies Building, New York city, on Friday evening, January 14. President L. B. Stillwell called the meeting to order at 8:20 o'clock. Assistant Secretary F. L. Hutchinson announced that at the meeting of the Board of Directors held that afternoon eighty-eight Associates were elected, and four Associates transferred to the grade of Member. The annual dinner for 1910 was announced to be held at the Hotel Astor on Thursday evening, February 24, 1910.

A paper entitled, "The Space Economy of the Single-Phase Series Motor," written by Profs. W. S. Franklin and S. S. Seyfert, was the subject for discussion at the meeting. In introducing the author, President Stillwell spoke of the great importance at this time of the general question of the comparative weight and dimensions of single-phase motors in competition with direct-current motors.

Professor Franklin then presented the paper, an abstract of which is given below:

The sole object of this paper is to discuss the question as to the maximum single-phase series motor rating that can be placed within a given space, and indeed the authors approach this question, not on an absolute basis, but on a basis of comparison. Given a well-designed single-phase series motor of the usual construction, as represented, for example, by the motors of the present locomotives of the New York, New Haven & Hartford Railroad, the question is how great an increase of rating can be realized by certain alterations in the design and by the use of certain new auxiliary devices. This question admits of a qualitative answer in every particular and of a quantitative answer in several important particulars.

A single-phase series motor differs from a direct-current motor: 1. Because its power-factor is less than unity. 2. Because of greater core losses and because of power loss due to short-circuit currents. 3. Because of a great tendency to spark at the commutator.

From the viewpoint of the operating engineer, however, these differences may present themselves as a single difference as follows: (a) For a given frequency and rating, satisfactory operation may necessitate a very bulky and expensive motor; or (b) for a given size and rating, satisfactory operation may require the use of a very low frequency; or (c) for a given size, given frequency, and given rating, it may be impossible to realize satisfactory commutation.

Thus it may be said that the disadvantage of the single-phase series motor lies either in its excessive size, or in the necessity of using extremely low frequency, or in the unsatisfactory character of commutation. If, however, we choose a frequency of twenty-five cycles and set ourselves to meet the condition of satisfactory commutation—and we must meet this condition in any case—then the disadvantages of the single-phase motor reduce themselves solely to the question of size and weight. There is much left to be desired in the way of increase of motor rating for a given weight of locomotive, especially an increase of tractive effort at starting, without increase of motor weight.

Inasmuch as this paper refers almost wholly to matters of design, it is desirable to give a statement of the conditions which determine the design of a single-phase series motor (a) to produce a moderately large power factor, and (b) to reduce the tendency to spark at the brushes.

Fig. 1 is the well-known clock diagram in which I represents the current flowing through the motor, E the voltage acting across the motor terminals, X_fI and R_fI the reactance and resistance drops respectively in the field winding, X_aI and R_aI the reactance and resistance drops respectively in the armature and neutralizing windings combined, and E_c the induced counter electromotive force in the armature due to rotation. It is evident from this diagram that a large power-factor (small value of the angle θ) depends upon a large value of E_c in comparison with X_fI and X_aI. Of course R_fI and R_aI should both be as small as possible because they represent energy losses in the windings.

In the first place the reactance X_aI of the armature winding may be reduced nearly to zero by the use of the neutralizing winding.

In the second place, consider the reactance drop X_fI in the field winding. For a given

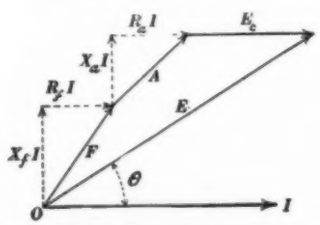


FIG. 1.—CLOCK DIAGRAM OF SINGLE-PHASE SERIES MOTOR.

frequency this is proportional to the product of the number of field turns and the maximum value of the alternating field-flux, exactly as in the case of the primary coil of a transformer. Assuming that we have a motor in which a specified maximum flux is to be produced, then to make the reactance voltage X_fI a minimum, the machine must be designed so that the desired field flux may be produced by the least possible number of field turns. That is, the reluctance of the magnetic circuit must be small; or, in other words, the gap-space between the pole faces and the armature core must be short, and the iron of the field magnet and armature core must be operated at a low degree of magnetic saturation.

In the third place, the value of E_c may be increased for a given value of speed and given value of field flux by increasing the number of armature conductors. Therefore the use of a large amount of armature copper is an important feature of this motor.

In the fourth place, suppose we have a single-phase series motor running at given speed with given value (effective) of current and given value (effective or maximum) of field flux. Under these conditions E_c is definite in value (effective), the mechanical power E_cI is definite, and a reduction of the frequency produces a proportional reduction of the reactance voltages X_fI and X_aI without affecting the value of E_c, that is, a reduction of frequency increases the power-factor of the motor. Therefore it is important to use low-frequency current for this motor.

A number of undesirable effects are included in the general term of sparking, as follows: (*a*) The effects that are present in a direct-current machine and which are due to the necessity of a quick reversal of the current in a given armature section as the terminal bars (commutator bars) of the section pass under a brush; and (*b*) the effects that are present in the alternating-current machine due to the excessive current which is produced in each short-circuited armature section by the pulsations of the field flux.

The first is quite familiar to designing engineers and need not be discussed. The effects of excessive short-circuit currents due to pulsations of field flux are: to heat the armature winding; to heat the commutator; to heat the brushes; and to roughen the commutator by sparking. The remedy is, of course, to prevent excessive short-circuit currents and to shorten their duration as much as possible.

The electromotive force induced in a short-circuited armature section by the pulsating field flux is proportional to the number of turns of wire in the section, to the maximum value reached by the pulsating field flux, and to the frequency. Therefore the short-circuit current may be reduced by reducing these quantities. It is essential, therefore, in the design of the single-phase series motor to provide for few turns of wire per

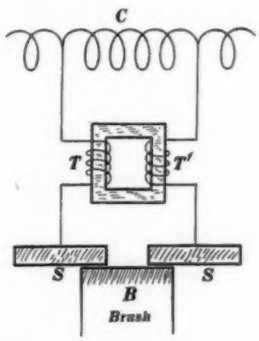


FIG. 2.—BALANCED CHOKE-COIL ARRANGEMENT.

armature section (many commutator bars); to provide for small field flux per pole (many field poles); and to use current of low frequency.

The duration of short-circuit of an armature section by a brush is proportional to the thickness of the brush, and therefore it is desirable to use thin brushes. If the armature winding is of the simplex type, the necessary thickness of the brushes is determined solely by the necessary area of brush-contact to collect the given current. If the winding is of the multiplex type, a brush must never touch fewer than n commutator bars, where n is the number of constituent windings in the multiplex winding.

The foregoing discussion refers to those general features of design which tend to reduce short-circuit currents in the armature sections of a single-phase series motor. It does not seem to be possible, however, to produce a motor of this type that will operate satisfactorily without the use of special devices for the prevention of excessive short-circuit currents. The simplest device for this purpose is the insertion of a moderate amount of resistance in each commutator lead. This device is well known and need not be further discussed. A number of special inductive devices have also been proposed, and perhaps the best of these is the balanced choke-coil arrangemet of S. S. Seyfert.

The essential features of this arrangement may be seen in Fig. 2 in which C is a section of the armature winding, S S are two commutator bars and T and T' are two coils on

a small iron core. These two coils are so connected that their magnetizing actions on the iron core are equal and opposite when equal currents flow into (or out of) the armature winding through both coils; whereas their magnetizing actions work together when current tends to flow out of the armature winding through one coil and into the armature winding through the other coil. The resultant effect is that current can flow into or out of the armature through both coils T and T' without being choked, whereas opposite currents in the coils T and T' (due to the short-circuit current in the section) are greatly choked.

In order to test the efficacy of the balanced choke-coil arrangement, it was applied to a single-phase series motor and tested. The pressure between adacent commutator bars near the brushes was nineteen volts effective when the motor current was 31.8 amperes, and yet the commutation was entirely satisfactory; even with a motor current of 35.2 amperes no more sparking was in evidence than is usual on a direct-current motor of the same size. Indeed the commutator was in perfect condition after a long series of test runs. A single and momentary trial of the armature without the choke-coils exhibited a superlative degree of sparking, as was to be expected.

In the direct-current motor the field should be much stronger magnetically than the armature and it should, therefore, be the external member to give room for the field-windings; in the alternating-current commutator motor, however, the armature must be the preponderating member and it should, therefore, be the external member to give room for the armature windings. An internal-rotating-field external-stationary-armature type of direct-current dynamo was brought out a number of years ago in England, but this type of direct-current machine is now entirely discredited both practically and theoretically. The internal-field external-armature type of single-phase series motor, however, presents very great advantages as follows: (*a*) It presents more available space for the windings. (*b*) It makes possible a material shortening of the end-connections of the compensating windings without lengthening the end-connections of the armature windings. (*c*) It makes possible the removal of all non-sparking devices from the motor region proper, relieving the designer of every limitation in the use of resistance leads or other non-sparking devices except the limitation of cost and weight. (*d*) It makes possible the detaching of the commutator and the utilizing of the large amount of space ordinarily occupied by the commutator for motor iron and motor copper.

What may at first sight appear to be a disadvantage in the detaching of the commutator is the necessity of driving the brush mechanism by gearing, but the transmission of the power required for this purpose does not present a serious problem; indeed, it would seem that the advantage of having the commutator and brushes always in view and always easily accessible would counterbalance any mechanical disadvantage involved.

Two single-phase series motors having the same external and internal dimensions were designed, one of the ordinary design with internal armature and external field, and another the new design with internal field and external armature. Three independent calculations were made of the weights, losses, and efficiencies of these two machines by experts. These calculations were substantially in agreement, and showed a remarkable difference in rating of the two types of machine. The internal-field external-armature type of machine has a rating which is approximately twenty per cent in excess of the rating of the external-field internal-armature type of machine.

After having been led to the external-armature internal-field type of construction for the single-phase series motor, the authors realized the very great advantage to be obtained by removing the resistance leads, or other non-sparking devices, from the motor region proper. These advantages are: 1. That resistance leads and balanced choke-coils, for example, can be used regardless of the amount of space they occupy so that the advantages to be gained by the use of such devices may be pushed to the limit, thus enabling the designer to produce a machine which commutates satisfactorily with a higher short-circuit voltage than would otherwise be possible. 2. The power losses in the non-sparking devices take place outside of the motor region proper and do not therefore have to be taken care of by ventilation. 3. Repairs to resistance leads, or other devices for preventing sparking, may be made with the greatest of ease and without opening up the motor in any way. 4. Arrangements can be provided for the short-circuiting of any portion of the resistance leads or the disconnecting of the choke-coils at any prescribed motor speed, thus enabling the designer to treat the problem of starting and the problem of steady running independently of each other.

Another great advantage secured by the adoption of the external-armature internal-field type of construction is the possibility of removing the commutator from the motor region proper and the consequent possibility of utilizing the motor region solely for motor

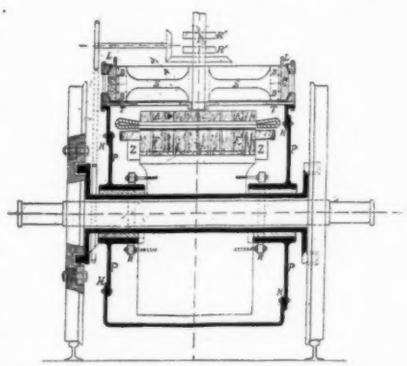


FIG. 3.—ARRANGEMENT OF SEYFERT SINGLE-PHASE SERIES MOTOR.

iron and motor copper. This change alone represents a possible increase of about sixty per cent in the motor rating that can be placed in the region occupied by the motors of the New York, New Haven & Hartford locomotives, and it has the further advantage that the commutator losses occur outside of the motor region proper, thus simplifying the problem of ventilation.

The authors have worked out in succession the more important details of design of five single-phase series motors in their application to the principles set forth in this paper. The last of these studies in design related to a twenty-five-cycle motor to be placed between sixty-two-inch drivers on a standard-gauge locomotive. Fig. 3 is an outline sketch of this motor; $F\,F$ is the internal rotating field and $R\,R$ the collector rings for leading current into and out of the field and compensating windings; $Z\,Z$ are the end-connections of the compensation windings, $A\,A$ is the external stationary armature, $C\,C$ the detached commutator, $S\,S$ the rotating-brush arms which carry the brushes $B\,B$, and $R'\,R'$ the collector rings for supplying current to the rotating brushes. The axis of the commutator is vertical, and the commutator is represented as being a hollow cylinder with the commutating surface on its interior. The brush shaft is supposed to be supported by arms which project to the front and back parts of the motor casing; these supports are not shown. Immediately above the commutator and surrounding the commutator lugs $L\,L$ a set of terminal bars are to be provided to which the armature leads are to be connected, and the resistance leads and balanced choke-coils are to be connected between these terminal bars and the armature lugs and placed in any convenient position in the locomotive cab.

Provision is made for removing the internal field for repairs by sliding it out endwise. The details of this arrangement are shown with sufficient clearness by the holes H in the two ends of the motor casing, and the plates P which cover these holes; the left-hand driver is provided with a detachable rim so that what remains of the driver when the rim is detached can pass through the armature of the motor.

It was decided to adopt a ten-pole field instead of a twelve-pole field as in the present New Haven motors. This decision was reached on the basis of a conviction that satisfactory commutation can be accomplished with twelve volts between commutator bars at the brushes by the free use of non-sparking devices which is permitted by the internal-field external-armature type of construction.

S. M. Kintner, in opening the discussion of the paper, said that the authors had dealt with the subject in a very heroic manner, and the methods proposed for increased output were certainly radical to the extreme. A comparison of the output of the proposed 500-horsepower motor, that the authors submit as one that could be operated within the space limits of the present New York, New Haven & Hartford locomotive motors, shows that there is no gain in output per unit weight of active material, i. e., copper and laminated iron. The attempt to gain has been made by dividing the motor up into two parts, one of which is made up of the magnetic circuit and inductors and which occupies all of the available space at present used by the entire motor on the New Haven locomotives, and the other part, made up of the commutating device, with its necessary choke coils for keeping down the short-circuit currents, is proposed to be placed in some convenient location outside the motor frame and has its own additional space requirement. In criticizing the proposed design, Mr. Kintner stated that the insulation allowances in the proposed motor are much too small, there being but one-half that allowed in the armature slots of standard machines, which allowance the experience of years has indicated as the minimum that is safe. Further, the method of getting the windings in place with the proposed slot, copper and insulation dimensions, is by no means evident. The number of commutator bars selected is such as to cause some difficulty in connecting the equalizers. He did not believe an ex-

ternal commutator with revolving brush-holders can be built for this class of service which will be a commercial success. He thinks the difficulties involved are enormous. Among these are the construction of the commutator with its flexible connections from the motor windings, through the choke coils mounted on the locomotive cab, to the commutator bars; the mechanical arrangement necessary for driving the brush-holders synchronously forms a problem in construction that has no feasible solution. It seems to be almost impossible to devise a satisfactory arrangement of this kind when viewed from the standpoint of reliability, accessibility for inspection and repairs, freedom from mechanical injury during overhauling other parts of the locomotive, first cost, etc. Again the increased complication, cost and maintenance expense of the two sets of collector systems for supplying current to the brush-holders and to the rotating field, is another serious feature of this type of motor. While the authors' statement that but little power would be required to drive the rotating brush-holders is probably true, it does not necessarily follow that no serious difficulty is involved in the construction of such a drive. It is a well-known fact that single-phase commutator motors are very sensitive as regards brush setting, and great care is taken to insure a correct setting on the present types of motors to within less than one-sixteenth of an inch, as measured on the commutator face. The brush-holders, if rotated at motor speeds, would all need to be carefully balanced and the carbon springs would require some form of compensator on account of centrifugal forces which would otherwise cause unequal brush pressures. As regards the question of balanced choke-coils for limiting the magnitude of the short-circuit currents, one is surprised to find how large these coils become. Two other points that should be considered in connection with the choke-coils as determining factors of their value: First, their ability to withstand without injury heavy momentary overloads, such as they might be subjected to in the event of the motors not turning over at once when current is applied at starting, and, second, the character of their construction combined with an adaptability for ready assembly in a suitable manner and at a reasonable cost. There is approximately as much resistance in the copper of the choke-coil as would ordinarily be used in a regular resistance load, and that this alone would have been sufficient to limit the short-circuit current without the inductive effect. This indicates a serious sacrifice in ruggedness and overload capacity in order to keep down the size to such proportions as would allow the choke-coils to be mounted inside the armature. Therefore, when compared with resistance leads properly installed, choke-coils seem to be less desirable. Mr. Kintner took exception to the statement that it does not seem possible to produce a single-phase motor that will operate satisfactorily without the use of special devices for the prevention of excessive short-circuit currents. There are a great number of motors of this kind in operation giving satisfactory service. The contact resistance of the carbon brush is sufficient to limit the current to a safe value, provided the short-circuit voltage does not exceed three and one-half to four volts. The employment of preventive leads allows the use of higher inductions per pole and in general results in a somewhat smaller motor for the same rating. The space available for the motor of a locomotive depends so much on the type of motor mounting and drive, that comparisons on the basis of output of motor designs of different types are misleading. Mr. Kitner went into the question of permissible size of motor for various methods of mounting the motor and for various locomotive speeds. When use is made of the combination drive employing gears and side rods, there is a distinct gain in the end room space available for the motor. This increase in end room makes a smaller diameter and higher speed motor possible and hence a cheaper motor. This type of mounting gives almost as much end room as that employing the straight side-rod drive, the latter having a slight advantage, as it is possible with it to extend the motor up to the wheel flanges and in fact to cut away part of the motor housing for a still slight gain. With both of these types of drive the diameter of the motor is limited by cab clearances. The combination drive is much more flexible and gives a better selection of motor speeds and driver sizes.

E. H. Anderson said the scheme of placing reactances in such connection as to theoretically reduce sparking is ingenious to say the least, but a criticism of the scheme is that it does not make for simplicity. In order to take the motor apart for repairs it becomes necessary to pull a driving wheel off or separate the stationary member, and in this case it becomes necessary to disconnect the winding and all the commutator leads coming from the lower half. The driving mechanism for the revolving brush-holders must be positive and rigid. No slack or looseness can be allowed, for the exact position of the brushes on a single-phase commutator motor is very essential for proper operation and speed. The power of a motor is dependent largely upon the length of core, and if all of the commutator length could be put into core, it makes it possible to have a larger motor. However, all the commutator length cannot be added to the core. Usually out of a given space, a certain amount of heat can be blown out so that with a given efficiency only a given amount of work can be done in that space. The question naturally arises, is the taking away from the rotary member of the commutator and placing the same on the stator worth the complication? It appears that this scheme is best suited for single-phase axle motors for locomotives and is limited to the construction of mounting the stationary member on a quill and using quill drive.

E. F. W. Alexanderson, in discussing another phase of the subject, said that in the design of any electrical apparatus, there is usually one requirement that is more severe than any of the rest, or one weakness in the type of apparatus considered to which most of the attention must be given, so that all the other features must be subordinate to that particular consideration. The three principal limitations in the design of an alternating-current railway motor are heating, commutation, and starting torque: Of these the starting torque is, however, the most important. In the first attempts to design these motors they were totally enclosed and the service capacity was determined from the heating characteristics. It was soon found, however, that due to the lower efficiency of the single-phase motor, the temperatures had a tendency to become considerably higher than in the direct-current motor. At present, it is accepted as a necessity by all manufacturers of alternating-current railway apparatus that the motors must be

cooled either by natural or forced ventilation. As soon as forced ventilation is adopted in an alternating-current motor, the cooling that can be accomplished in this way is so effective that heating is no longer the limiting feature of the design. Commutation difficulties can be entirely overcome at any normal operating speed by application of a commutating field of suitable phase and strength; they can also be counteracted to a great extent by the use of so-called resistance or preventive leads. The ruling feature is therefore the starting torque. This applies to the three-phase as well as the single-phase railway motor, although for entirely different reasons. The starting torque of the single-phase commutator motor is limited by the voltage per bar on the commutator, and the current per bar in the winding. Generally speaking, it can therefore be said that the starting torque is proportional to the size of the commutator. The special methods that are used to increase the starting torque consists in providing means for either raising the voltage per bar or means for raising the current per bar. In other words, both systems require space in the motor which could otherwise be usefully employed if the motor were intended for direct current. The scheme presented by the authors is the first of the two mentioned principles for increasing the starting torque carried to the extreme. The system is, according to the authors, very effective, but there is also every indication that it takes room in proportion to its effectiveness, and there is no convincing evidence that the space occupied by the motor with its elaborate non-sparking devices, will not be quite as large as the space of a motor designed along familiar lines. This refers to the motor of the Seyfert type with rotating commutator. The scheme of the detached commutator apart from its complication does not solve the problem of space factor as it is worked out in the design shown in the paper. A natural solution is, however, given by the use of side rods, which allows the commutator as well as the rest of the motor to assume its necessary dimensions as well as its natural proportions. It is interesting to observe that the results obtained by the four or five manufacturers of single-phase railway motors in America and in Europe agree closely in regard to weight and space per horsepower. The various schemes employed for overcoming commutation difficulties can not be judged by the space factor or the weight per horsepower. That type will undoubtedly be most favored which offers the greatest simplicity of structure, and the easiest work for the repair man.

Prof. S. S. Seyfert stated that it seemed during the discussion that the non-sparking devices that are proposed were assumed as a part of the inversion of the relative composition of field and armature. It is not necessary, however, to use these choke-coils in the case of a motor with external armature. He had often thought it might be desirable to use resistance leads only under certain circumstances, especially if the short-circuit volts are reasonably small. He had found it extremely difficult to design a motor of so large size with a reasonable short-circuit voltage per turn, for if there is a reasonable number of turns, say twelve, the flux per pole on a 500-horsepower motor will be so large as to give the twelve volts per turn on the armature circuit and over, and to reduce that voltage any further would either require to tape on the half turn or increase the number of volts. In order to build a large single-phase motor, it is absolutely necessary to use a large number of poles, or use a high short-circuit voltage. Mr. Seyfert thinks it is plain that with the ordinary construction of armature, in which the resistance leads are doubled upon themselves in the bottom of the armature slots, they consume a large amount of valuable space, real motor space, and add their heating to the total heating of the armature. In case of burn-outs, which are liable at starting, the armature windings have to be undone to repair the trouble. In this case, he could easily imagine an arrangement of the leads so that they might be replaced at short notice separately, and in fact a lead might be replaced while the motor was running, in case the winding of the armature was of the proper type, because there are several resistance leads in multiple when the brushes are wide enough to cover them by any one segment. The placing of the armature winding externally enables us to proportion the armature slots more nearly in accordance with commutating requirements. The armature slots do not have to be so deep, because there are greater commutating lengths. Consequently, the motor can be designed to commutate more readily. The impression that the core losses per unit of volume in the armature of the alternating-current motor should diminish as synchronizing speed is reached is according to theory, but for some reason or other the core losses actually increase somewhat as was found in a series of tests.

President Stillwell called attention to the fact that the arguments in favor of the increase in output in proportion to dimensions are greatest in the case of multiple-unit equipment, but the paper makes no suggestion as to the location of this commutator and its leads. In the case of the electric locomotive, taking the state of the art as it existed when the New Haven locomotives were designed, using twenty-five cycles, the designers were undoubtedly cramped for room in attempting to place the motors underneath the floor of the locomotive, but the tendency is now rather towards raising the motors, in some of the recent types at least, and gearing to the shaft, in which the argument in favor of separate commutator and its leads from the field armature would seem to be somewhat minimized.

Prof. W. S. Franklin closed the discussion by pointing out in regard to the location of the detached commutator in the multiple-unit car that it seemed that a very great advantage would be reached by placing the motor on one side of the truck and the commutator on the other side, taking the commutator leads across in a covered passageway over the axle. A commutator is a switchboard, and the proper place for the switchboard is detached. He never saw a powerhouse with the switchboard placed inside of the dynamo. We get so accustomed to a certain point of view, that a departure from it seems to us utterly absurd. Perhaps, after all, the detached commutator is the rational thing. He is not fully convinced. As to the carrying capacity of the choke-coil, which makes a very heavy winding necessary to carry the large currents at starting, some of these difficulties can be overcome by providing a scheme of short-circuiting the choke-coils, which can be cut out entirely at starting. He called attention to one of the really important points in the suggested design, namely, that one can treat the problem of starting and the problem of running as two distinct and separate problems of design.

CENTRAL-STATION PRACTICE

Transmission—Interior Wiring

POWER-HOUSE ECONOMICS IN BALTIMORE.[1]—III.

BY HORATIO A. FOSTER.

NORTHERN OR HARTFORD ROAD, SUBSTATION NO. 2.

Studies of the conditions at the existing Northern substation showed it to be overloaded, and the load on it fast increasing. All calculations indicated that the best results as to supply and economy of the same would be obtained by enlarging this station, rather than by starting another at some other center, there being a considerable surplus of feeder copper already connected to the station.

Arrangements were therefore made for duplicating the existing building as to size and external appearance, although keeping it separate in every respect; and to equip it with units of somewhat larger capacity; also to rearrange the control of both stations in a somewhat improved manner.

The building is of brick, on a steel frame, with concrete basement floor and building foundations, and concrete foundations for the rotaries. This building is designed to receive an equipment of four 1,500-kilowatt rotaries, with all necessary transformers, switching gear, etc., but two only are installed at present. The control of the switching gear is for convenience located in the original station, in connection with the control and switching apparatus of that plant. This insures the lowest cost of operation and, as the new apparatus is for use in conjunction with the old, makes decidedly the best arrangement from an operating standpoint. This new station is entirely separate and distinct from the old, the wall of the old station not even being used as a party wall, except as a parapet above the roof. The only connection between the two is that of the cables carrying the direct current from the rotaries to the distributing switchboard in the old house, and the small control cables and connections from the switching gear, located in the new house, to the control panels which are, for convenience of operation, located with the others in the original station. The equipment and general design are quite similar to those of the central substation, with such variations as were necessary for carrying the direct-current output of the rotaries through the old house.

The new house is equipped with an overhead, electrically operated traveling crane of twenty tons capacity. It happened that the two new rotaries were almost ready for operation at the time of the destruction of the Falls Road power house by fire on the night of October 5, 1907, and, by a little hurried work, these machines were made ready and connected to the line in time to provide a fairly good service for the lines deprived of power.

NORTHERN SUBSTATION, NO. 2.

BAY SHORE POWER STATION.

Bay Shore is an amusement park located upon the shore of Chesapeake Bay, some fifteen miles from the center of Baltimore City, and twelve miles away from the nearest substation, that at Eastern avenue. During the first season that the park was opened—that of 1906, beginning some time in August—it was supplied with power for operating the cars through a number of low-tension cables operated from the substation at Eastern avenue. Lighting was also supplied from the same source through two three-phase circuits running on the telephone lines over another route to the park. The power was found to be quite inadequate as installed, the lighting very poor and uncertain, and for both these reasons it was felt that it was necessary to provide an absolutely continuous supply for the approaching season of 1907, and the studies indicated that all the conditions could be best met by the establishment of a power plant closely adjacent to the park itself. The main consideration leading to this decision being the prevalence of lightning during the summer storms, to which the long overhead line between the Eastern avenue substation and the Park was fully exposed. The lighting and power for the park as supplied from Eastern avenue were several times affected and the lights and power shut off during an evening's entertainment. The price of copper for the season of 1907 also added further argument to strengthen the opinion in favor of the local power station, as it was estimated that the cost of copper to ob-

1 Reprinted, by permission, from the *Journal* of the Franklin Institute, November, 1909.

tain the same results would be several thousand dollars more than a whole new power station, and would then be subject to the dangers from lightning, above mentioned. Deliveries of electrical apparatus were so backward in the spring of 1907 that it would have been simply impossible to have had this station in readiness for the season, and advantage was taken of the fact that the company already had considerable good steam and electrical apparatus in stations that was not in use, and high-class units were selected from this unused machinery and a station was designed for their reception. It was not considered practicable to locate this station close to the park, owing to the smoke from its chimneys, and the first location selected was close to the shore of the bay, along the return railway track, but the owner of the property

BAY SHORE POWER STATION.

refused the use of this point, as he desired it for residential purposes, and insisted that the station be located at least five hundred feet back from the shore, which was eventually done—along the curve of the return track. A little over an acre of ground was purchased, so shaped as to accommodate the spur tracks for coal trestle and station use, and the building is so located upon this land as to permit of further extension at any time should future growth demand it.

After excavating to a sufficient depth, piles were driven to furnish a firm foundation for buildings and machinery, and a reinforced concrete building of plain but substantial and fire-proof design was constructed. There is nothing whatever in this building to burn, but the window sash, frame and doors, and if they were entirely destroyed that would be practically all the damage possible. Even the destruction by fire of the wooden bulkhead, which is used for closing the rear of the boiler room in winter could do no further damage. This station is equipped with two 600-horsepower Morin-Climax boilers, two 300-horsepower boilers of same make, one Westinghouse-Kodak generator and engine of 375-kilowatt capacity, one Kodak generator—same make—200-kilowatt capacity, for supplying 500-volt direct current to the park for miscellaneous power purposes, and four Thompson-Houston, 200-kilowatt, 550-volt generators driven by belt from four tandem compound McIntosh & Seymour engines; these generators being used in connection with the 375-kilowatt Kodak unit, for supplying current for the local section of the railway for a distance of about three miles back. The steam piping and feed-water system, which by the way is taken from a couple of driven wells on the property, one of 400 feet and the other of 600 feet—is all so designed as to provide against the least chance of shutdown from trouble in that direction, and in fact the whole design of the station has been made with a view to absolute continuity of operation.

There is also installed in this section a new 250-kilowatt, three-phase, alternating-current generator for supplying the lighting at the park in connection with the supply from the Eastern avenue substation. This generator can be used alone or in connection with a line from the Eastern avenue substation, or can be held in reserve for use in case of trouble on that line. In order still further to insure continuity of this lighting supply, a small fireproof building of reinforced concrete was erected at the park, and the three seventy-five-kilowatt transformers through which the transmitted current of 3,300 volts is reduced to 110 volts for the park lighting, were removed to it from a temporary wooden shed. The apparatus for this station was increased by one seventy-five-kilowatt transformer, a duplicate of the other three, and this has been so installed as to permit its connection to replace any one of the three that should for any cause be damaged. A forty-horsepower motor-generator is also installed in this building for supplying 110-volt direct-current to various small appliances about the park. This power station at Bay Shore was constructed under numerous difficulties, the machinery being installed as soon as the foundations were ready for its reception, and without waiting for the building, so that by the time the roof was in place practically all the machinery had been in service supplying current for the season.

DRUID HILL SUBSTATION.

The equipment of this station was increased by the addition of a 1,500-kilowatt, rotary converter and its transformers, but a 500-kilowatt machine was removed from this house to the substation at Nunnery Lane, which is completed and rounded out by the addition.

Two additional high-tension cables were added to the two existing cables connecting the substation with the Pratt street power house.

The busbar pit for high-tension connection was much enlarged and some of the low-capacity switchboard panels on the direct-current feeder side were replaced with others of much increased capacity taken from the temporary substation on Dugan's Wharf. This station has been much relieved since the new central substation on Lombard street was put in full operation.

EASTERN SUBSTATION.

This station was originally designed to accommodate six rotaries of 1,000 kilowatts each. Only three machines were in place up to the spring of 1908, when the three 1,000-kilowatt rotaries at Dugan's Wharf were transferred to this station and the switching structure and control panels were re-arranged to care for their output.

RESULTS.

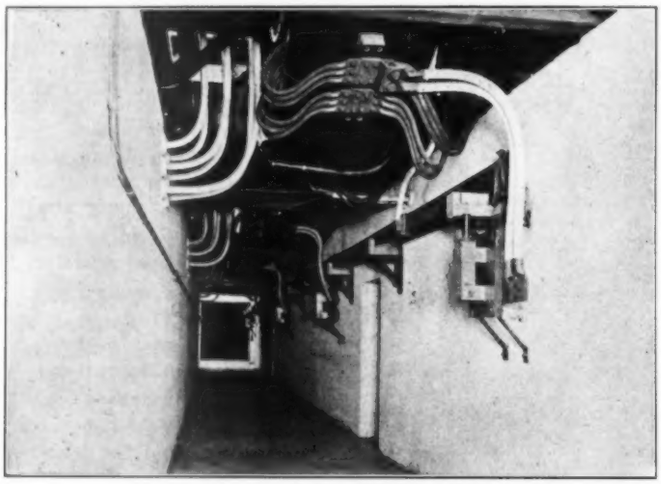
Owing to the chaotic condition of the power equipment in the summer of

1906, including not only that at Pratt street, which was undergoing many changes, but of the outside smaller steam operated plants as well, the whole operating forces needed not only weeding out but reorganizing and this was taken in hand vigorously.

The Pratt street force in December, 1906, consisted of 154 operators; this was gradually reduced during the year until in December, 1907, there were 121, while the output had increased by more than 750,000 kilowatt-hours. As Pratt street took on more power, the outside plants were closed, thus doing away with much labor.

Many other economies were introduced and much attention was paid to the coal consumption, that being by far the largest item of expense connected with the plant.

Carbon-dioxide apparatus was installed to assist in the training of firemen, and one boiler was fully equipped for testing and many trials were made in order to determine the best conditions of load under which to operate, and the conditions giving the lowest consumption of fuel.



CENTRAL SUBSTATION, BASEMENT.

In January, 1907, the coal consumption per kilowatt-hour for all stations was 4.4 pounds, while for December of the same year it had fallen to 3.2 pounds.

At the Pratt street station the coal consumption for the month of January, 1907, was quite abnormal, being 4.3 pounds per kilowatt-hour, while in December of the same year it had decreased to 3.15 pounds and during the months of July and August it was 2.95 and 2.9 pounds, respectively. This consumption of coal fell to 2.8 pounds per kilowatt-hour in August, 1908. This was owing to the fact that nearly all the smaller outside plants had been shut down, thus throwing the large part of the load on Pratt street station.

The kilowatt-hour output of the Pratt street station as compared with all station changed as follows:

	Pratt street.	All stations.	Per cent on Pratt street.
1905.....	56,266,576	70,031,906	80.0
1906.....	70,932,528	87,946,479	80.8
1907.....	87,543,846	100,665,951	87.5
1908.....	92,412,742	99,345,544	93.0

The consumption of coal per kilowatt-hour for the several years is shown in the following table:

	Coal in pounds per kilowatt hour. Pratt street.	All stations.
1905.....	3.65	3.87
1906.....	3.55	3.81
1907.....	3.25	3.48
1908.....	3.09	3.28

The cost per kilowatt-hour for all stations decreased during the year 1907 to eight per cent below that of 1906; while for the year 1908 this cost had fallen some twenty-three per cent below that of 1906.

Owing to the fact that all the power can never be supplied from Pratt street station solely, the cost per unit for the whole output will always be somewhat higher than that for those stations of large size supplying all the power that is used. However this cost will compare very favorably with any of the other large plants in the country which are equipped with reciprocating engines.

The power plants and equipment of the United Railways and Electric Company are now as follows:

	Kilowatts.
Pratt street, alternating current	25,500
Pratt street, direct current	5,400
Bay Shore, alternating current for lighting	250
Bay Shore, direct current	1,375
Owings Mills, direct current	1,080
Light street, direct current, reserve	2,000
Falls Road, direct current, reserve	750
Total alternating current	25,750
Total direct current, generators	10,600

Substations equipped as follows:

	Kilowatts.
Druid Hill	5,500
Northern or Harford Road	7,000
Eastern Avenue	4,000
Nunnery Lane or Arlington	2,000
Central substation	7,500
Total	26,000

As the power equipment now stands, there is one unit in reserve in the Pratt street power house and in each of the substations.

In closing, I can do no better than to quote from an editorial which appeared in the *Street Railway Journal* last spring:

The writer says: "There is no task that gives a finer scope for engineering skill than the reconstruction and modernizing of an important plant in full operation. Any kind of mediocre talent enables a man to sit down with a bunch of manufacturers' catalogues and the blue prints of a few of their latest creations, and lay out a station that will be gleefully described as "following standard practice." This bears the same relation to engineering that stencil work does to art. To take a big system and keep it running, while its power equipment is being turned inside out, and to renovate it without needless cost, is a task of a very different order."

Electricity Progresses in Holyoke, Mass.

The electrical output in Holyoke, Mass., for the year 1909, shows an increase of 50.8 per cent over the previous year, while the increase in the gas business was only 1.6 per cent. Many mills and private customers changed over from gas to electricity. The profit on the plants is given at $43,654.60. The above particulars are from the seventh annual report of the City Gas and Electrical Department (Manager W. H. Snow), of Holyoke, Mass., and show a very satisfactory state of affairs in the "paper city."

Special Electricity Rate for Radiators.

A special rate of three cents per kilowatt-hour has been made at Southend, England, for electricity to be supplied to radiators.

ELECTRIC LIGHTING and ILLUMINATING ENGINEERING

The Three-Voltage Rating of Mazda Lamps.

The Mazda incandescent lamp when operated at an efficiency of 1.25 watts per candle has proven itself far more economical than either carbon, Gem or tantalum lamps on all costs of energy above a few cents per kilowatt-hour. There are some cases, however, in which the cost of energy per watt-hour is very low, perhaps a small fraction of a cent. In such cases a cheaper and less efficient lamp may show greater economy in operating expense than the Mazda lamp operated at 1.25 watts per candle. The somewhat higher renewal expense of the latter lamp at this efficiency may not be counterbalanced by even a great reduction in the amount of current used where the current is cheap. Since the Mazda incandescent lamp is inherently of higher efficiency and quality, the question of its economical application to any particular case merely depends upon its operation at the correct efficiency. In the case just cited, a small sacrifice in efficiency of the Mazda lamp could be made in order to reduce the renewal expense and thus secure greater economy than could be obtained with the other types of lamps even on very cheap power. Besides the actual saving in current made possible through the use of the Mazda lamp there is the very important possibility of releasing generating capacity, which even where the operating cost is low, may often be of great value. This point should not be overlooked in deciding the relative economy of high efficiency versus low efficiency lamps.

The incandescent lamp manufacturers have recently made a radical change in their methods of rating these lamps, in order that the lamps could be used with greater economy under those certain conditions, where heretofore their cost of operating exceeded that of a less efficient type of lamp and is most valuable in cases where the cost of electrial energy is low. The new method of rating, called the "three-voltage plan," is based upon the fact that for any given set of conditions, depending upon the cost of energy and cost of lamp, there is one particular efficiency and life at which it is most economical to operate a given lamp. Each Mazda lamp is labeled with three voltages two volts apart, as for example:

114
112
110

called top, middle and bottom voltage, respectively.

This method of rating makes it possible for a customer to select the particular efficiency of lamp he wishes to use, by specifying that either the top, middle or bottom voltage, as the case may be, should be the same as that of his lighting circuits.

When burned at top voltage the Mazda lamp has the highest efficiency or consumes the least energy for the light produced, and gives a life of 1,000 hours. At middle voltage more energy is consumed per candlepower produced and the life is lengthened (due to operation at a lower temperature) to 1,300 hours. At bottom voltage the lamp is operating at lowest efficiency and gives a life of 1,700 hours. It is obvious that the relative cost of lamp and energy will determine the most economical life and efficiency, since if energy is cheap the saving in energy obtained by operating the lamp at high efficiency is not sufficient to counterbalance the higher resulting renewal expense. On the other hand, if energy is relatively expensive then it will be desirable to operate the lamp at a high efficiency, since the saving in current at the higher rate will more than pay for the increase in renewal expense.

The efficiency of the different sizes of lamps at top voltage is not the same, since the larger lamps are relatively longer-lived than the smaller ones, and, in order to give all sizes a uniform life of 1,000 hours at the top voltage it was necessary to operate the twenty-five-watt lamp at 1.33 watts per candle, the forty-watt lamp at 1.25 watts per candle, the sixty, 100 and 150-watt lamps at 1.20 watts per candle and the 250-watt lamp at 1.15 watts per candle. The advantage of the new plan will be apparent by referring to table on p. 192 showing the cost of producing light with Mazda lamps. This table is based on list price of bowl-frosted Mazdas, and shows the total cost of operating the several sizes at top, middle, and bottom voltage with costs of energy from one cent to cents per kilowatt-hour. The total cost given in the table includes the cost of the energy consumed and the renewal expense involved in the production of a quantity of light equivalent to 100,000 lumen-hours, (which is equal to about 10,200 mean horizontal candle-hours in the case of the Mazda lamp).

In order to see how the most economical efficiency varies with the cost of

COMPARATIVE COST OF 100,000 LUMEN-HOURS CARBON, GEM, TANTALUM AND TUNGSTEN LAMPS WITH ENERGY BELOW 1c PER K. W. H.

	Carbon		Gem	Tantalum	Tungsten					
Rating	16 C. P.	16 C. P.	20 C. P.	20 C. P.	25 W.	40 W.	60 W.	100 W.	150 W.	250 W.
	3.1 W. P. C.	3.5 W. P. C.	Bot. Voltage	2 W.P.C. D. C.	Bottom Voltage					
Actual initial C. P.	16	16	16.7	20	16.1	28.0	43.5	72.4	108.6	188.0
Actual initial watts	49.6	56	47.3	40.0	23.3	37.8	56.5	94.2	141.2	235.0
Nominal W. P. C.	3.1	3.5	2.83	2.00	1.45	1.35	1.30	1.30	1.30	1.25
Hours life	800	1700	1450	1200	1700	1700	1700	1700	1700	1700
Ave. C. P. during life	13.20	13.06	14.00	21.66	16.46	28.30	42.60	71.50	107.2	179.7
Ave. watts during life	48.6	54.9	40.2	41.0	23.9	38.6	55.6	92.6	138.8	241.3
Reduction factor	82.5	82.5	82.5	77.0	78	77	78	78	78	77
Lumens	138	135	145	215	161	274	417	701	1051	1739
Cost of lamp std. pkg.	$0.18	$0.18	$0.225	$0.405	$0.648	$0.729	$1.012	$1.295	$1.822	$2.632
.2c	$ .233	$ .160	$ .162	$ .195	$ .266	$ .185	$ .169	$ .135	$ .128	$ .117
.3c	.269	.200	.190	.214	.281	.199	.183	.148	.142	.131
.4c	.303	.241	.218	.233	.296	.213	.196	.162	.155	.145
Cost of Power Cents .5c	.339	.282	.246	.253	.311	.227	.209	.175	.168	.159
per K. W. H. .6c	.374	.323	.273	.272	.326	.241	.223	.188	.181	.172
.8c	.445	.404	.329	.310	.355	.269	.249	.214	.208	.200
1.0c	.515	.485	.384	.348	.385	.298	.276	.241	.234	.228

energy refer to the table and consider for example the cost of producing 100,000 lumen-hours with a sixty-watt Mazda at the top, middle and bottom voltage with energy varying from one cent to twenty cents per kilowatt-hour. With the sixty-watt lamp and with energy at one cent per kilowatt-hour 100,000 lumen-hours can be produced most cheaply if the lamp is operated at the bottom voltage, the difference between the cost at top and bottom voltage with this cost of energy being about nineteen per cent. At five cents energy the bottom voltage is still the cheapest but is now only about three per cent cheaper than at top voltage. At eight cents per kilowatt-hour the top and middle voltages are as cheap as the bottom voltage and above eight cents the top voltage is the most economical. Where the per cent saving possible to obtain by operation at bottom voltage is slight, as for example is the case just considered with energy above five cents per kilowatt-hour it is far better to use the lamp at top voltage and thus secure not only a better quality of light but more light from a lamp of given size.

The greatest benefit can be derived from the three-voltage plan, however, on the low costs of energy, where operation at bottom voltage will then show economy for the Mazda lamps over either carbon, Gem or tantalum down to energy costs as low as 0.2 cent per kilowatt-hour.

The table on p. 191 shows comparative cost of producing 100,000 lumen-hours with carbon, Gem, tantalum and Mazda lamps with costs of energy from 0.2 cent to one cent per kilowatt-hour. This table is based on conservative total life values of the carbon and Gem lamps in place of the usual useful life, since practically all lamps are left in service until ultimately burned out rather than till they drop to eighty per cent of initial candlepower. The Mazda lamps have all been taken at bottom voltage, and the Gem lamp has been figured in the same way, as this is the most economical voltage for such low costs of energy. The average candlepower and watts during the life values shown have been taken in every case rather than the initial values. This has been done because the Mazda lamp maintains its candlepower much better than the other types, which is a distinct advantage in its favor and should be considered in comparing it with other types of lamps. The costs of lamps taken in this table are those for clear lamps in standard package quantity.

For energy costs above five or six cents any percentage saving that it is possible to obtain by operating the Mazda lamps at other than top voltage becomes so small as to be negligible in comparison with the better quality of light obtained at the higher voltage. Only in those cases where energy is very cheap should anything but top voltage be seriously considered. For ordinary use on central station circuits at the usual central station rates, top voltage should always be used. The prime object of the three-voltage plan, as applied to Mazda lamps, is to widen the field of its commercial application by making it competitive with the cheaper and less efficient lamps on low cost of energy.

TABLE SHOWING TOTAL COST OF PRODUCING LIGHT WITH TUNGSTEN LAMPS AT TOP, MIDDLE AND BOTTOM VOLTAGES ON VARIOUS COSTS OF POWER.

Nominal watts	25			40			60			100			150			250		
Nominal C. P.	20			32			48			80			120			200		
Voltage	Top	Middle	Bottom	Top	Middle	Bottom	Top	Middle	Bottom	Top	Middle	Bottom	Top	Middle	Bottom	Top	Middle	Bottom
Watts per candle	1.33	1.39	1.45	1.25	1.30	1.35	1.20	1.25	1.30	1.20	1.25	1.30	1.20	1.25	1.30	1.15	1.20	1.25
Actual watts	25.0	24.2	23.3	40.0	38.9	37.8	60.0	58.0	56.5	100	98.0	94.2	150	145.5	141.2	250	242.5	235
Actual C. P.	18.8	17.4	16.1	32.0	29.9	28.0	50.0	46.5	43.5	83.3	77.6	72.4	125	116.4	108.6	217.3	202.0	188.0
Total lumens	184.2	170.5	157.8	309.8	289.4	271.0	490.0	455.7	426.3	816	760	710	1225	1141	1064	2104	1954	1819
Lumens per watt	7.36	7.05	6.77	7.74	7.44	7.17	8.16	7.86	7.54	8.16	7.76	7.54	8.17	7.84	7.54	8.41	8.05	7.74
Hours life	1000	1300	1700	1000	1300	1700	1000	1300	1700	1000	1300	1700	1000	1300	1700	1000	1300	1700
K. W. H. cons. per 1,000 hrs.	25.0	24.2	23.3	40.0	38.9	37.8	60.0	58.0	56.5	100	98.0	94.2	150	145.5	141.2	250	242.5	235
Cost of frosted lamp	$0.85	$0.85	$0.85	$0.95	$0.95	$0.95	$1.32	$1.32	$1.32	$1.70	$1.70	$1.70	$2.40	$2.40	$2.40	$3.45	$3.45	$3.45
Lamp renewals per 1,000 hrs.	0.850	0.654	0.500	0.950	0.731	0.559	1.320	1.015	0.776	1.70	1.31	1.00	2.40	1.85	1.41	3.45	2.65	2.03

COMBINED COST OF POWER AND LAMP RENEWALS PER 100,000 LUMEN-HOURS, IN DOLLARS.

Variable cost of power cents per K. W. H.	25			40			60			100			150			250		
1	$0.60	$0.53	$0.47	$0.44	$0.39	$0.35	$0.39	$0.35	$0.32	$0.33	$0.30	$0.27	$0.32	$0.29	$0.27	$0.28	$0.26	$0.24
2	.73	.67	.61	.57	.52	.49	.52	.48	.45	.45	.43	.41	.44	.42	.40	.40	.38	.37
3	.87	.81	.76	.69	.66	.63	.64	.61	.58	.58	.56	.54	.56	.54	.53	.52	.51	.50
4	1.00	.95	.91	.82	.79	.76	.76	.73	.71	.70	.69	.67	.69	.67	.66	.64	.63	.63
5	1.14	1.09	1.06	.95	.93	.90	.88	.86	.85	.82	.82	.80	.81	.80	.80	.76	.76	.76
6	1.28	1.23	1.20	1.08	1.06	1.04	1.01	.99	.98	.94	.94	.94	.93	.93	.93	.88	.88	.89
8	1.55	1.52	1.50	1.34	1.33	1.32	1.25	1.24	1.24	1.19	1.20	1.20	1.18	1.18	1.19	1.11	1.13	1.15
10	1.82	1.80	1.79	1.60	1.60	1.60	1.50	1.50	1.51	1.43	1.46	1.47	1.42	1.44	1.46	1.35	1.38	1.40
12	2.09	2.08	2.09	1.86	1.87	1.88	1.74	1.75	1.77	1.68	1.72	1.73	1.67	1.69	1.73	1.59	1.63	1.66
16	2.63	2.65	2.68	2.37	2.41	2.44	2.23	2.26	2.30	2.17	2.23	2.26	2.16	2.20	2.26	2.06	2.12	2.18
20	3.18	3.22	3.27	2.89	2.94	3.00	2.72	2.77	2.83	2.66	2.75	2.79	2.65	2.71	2.79	2.54	2.62	2.70

Reduction Factor for 25, 60, 100 and 150-watt lamps=78 per cent; for 40 and 250-watt lamps=77 per cent.

Exports of copper for the week ended January 13 were 7,607 tons. Since January 1 they were 10,547 tons, compared with 10,110 tons the same period last year.

ILLUMINATING ENGINEERING SOCIETY.

ANNUAL MEETING IN NEW YORK CITY.

In addition to its yearly convention the Illuminating Engineering Society holds an annual meeting for the purpose of installing officers and hearing reports of its various business committees. The 1910 meeting, held at the Machinery Club, in New York city on the evening of January 14th, will be memorable owing to the blizzard which raged without as well as the delightful dinner which preceded the meeting within.

The retiring president, W. H. Gartley, engineer of the Philadelphia works of the United Gas Improvement Company, occupied the chair and introduced the various speakers with his usual dignified but nevertheless enjoyable pleasantries. He was particularly gratified at the increasing interest being taken by the members of the gas fraternity in the work of the society, and the past year had proved that in the great business of making and selling illumination there was room for all.

There were a number of informal addresses, the first by E. N. Wrightington, of Boston, president of The National Commercial Gas Association, who pointed out that the real business of both gas and electric companies in selling illumination, heat and power, instead of so many cubic feet, or watts, was much nearer being realized than ever before and that this was due largely to the work of the society. Taking up the matter of the conservation of energy, he stated that in no field was there greater opportunity for preventing economic waste than in lighting.

Mr. Gartley then introduced W. R. Addicks, vice-president and general manager of the Consolidated Gas Company, of New York, who stated that the gas industry needed the services of the illuminating engineer more than did the electrical industry, because gas installations were not as flexible as those where electricity was the illuminant and therefore should be planned with greater care.

He was followed by F. S. Terry, vice-president of the National Electric Lamp Company, who spoke of the great interest taken by his company in the society, especially as both gas and electric men had the opportunity of getting together on a friendly footing, as any improvement in one system was sure to benefit the other.

Secretary P. S. Millar then briefly abstracted his report as to the work accomplished during the year. The membership figures are as follows: January 1, 1909, 1,005; new members, 212; members dropped, resigned and died, 173; total January 1, 1910, 1,038. The various sections of the society held thirty-three meetings, the greatest average attendance being in Philadelphia with eighty-five.

The chairman of the finance committee, J. S. Codman, then presented a report of the financial condition of the society. Although $500 was spent on research work, the surplus was greatly augmented and is nearing the $3,000 mark.

The result of the annual election of officers was announced as follows:

President, Dr. Edw. P. Hyde.

Vice-President, V. R. Lansingh.

Treasurer, W. C. Morris.

General Secretary, P. S. Millar.

Directors, L. B. Marks, Dr. E. B. Rosa and E. W. Lloyd.

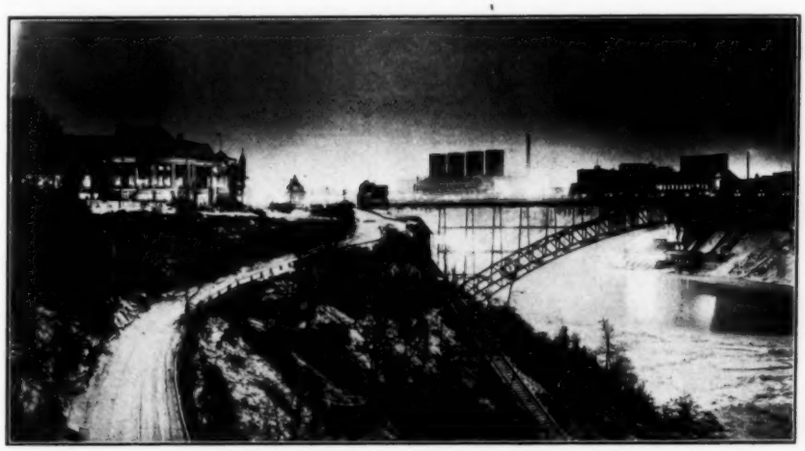
The popularity of the new president was at once apparent, to judge from the ovation he received. In his address he asked for co-operation to bring about greater harmony and a better understanding of illumination, and hoped that the society would be more successful than ever before in the dissemination of knowledge. If educational work was to be undertaken it should begin at home, and to that end a course of lectures should be given by the leaders in the art.

The last but not the least important matter brought up was the report of the committee on division of membership, which was read by the chairman, E. L. Elliott. The committee, while in favor of a division, was unable to make specific recommendations, and, after considerable discussion by Messrs. Jones, Marshall, Kemble, Gardner and Owens, on motion of Mr. Kemble it was proposed to continue the committee with instructions to report its suggestions in detail in ample time for discussion at the annual convention of the society.

After an informal discussion concerning the next convention the most successful annual meeting so far held was adjourned.

Evidences of Electrification at Niagara Falls by Night.

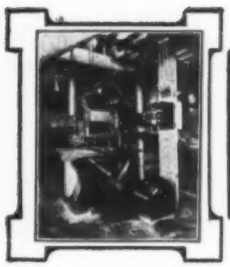
Winter time appears to add to the beauty of the electric light glow about the Niagara gorge. The snow on the debris slopes of the river banks and the ice floes that move from the base of the waterfalls down the gorge, impelled on by the pressure of the tumbling waters behind, as well as being caught by the currents of the stream that serves as a transportation agent between Lake Erie and Lake Ontario, brighten up the normal night gloom of the gorge.



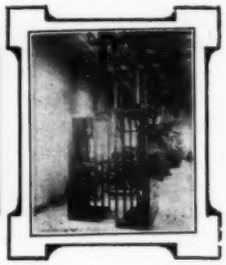
ELECTRIC NIGHT GLOW OF NIAGARA.

The scene illustrated is from a photograph taken from the roadway that extends from the clifftop on the Canadian side to the station of the Ontario Power Company at the water's edge close by the foot of Horseshoe Fall. Between the river to the right and the roadway at the left is seen the track of the electric railway incline which carries passengers to and from the Maid of the Mist dock. The bosom of the river is shown ice-laden, and over all stretches the handsome steel arch bridge of the International Railway Company, one of the connecting links of metal that bind the Dominion and United States in border ties close and friendly. Under the arch, at the water's edge, far in the distance on the New York state bank, are the Niagara Falls Hydraulic Power Company's station and the pulp mill of the Cliff Paper Company, the power house emitting an electric glow striking in the extreme.

Glancing along the sky line from left to right we see the Clifton House all aglow with light and hospitality, and next to it is the tower of the Niagara Falls Brewery, nearly a mile away, but appearing a close neighbor in the picture. Then comes the inclined railway station, and standing out high over the steel arch bridge are the four ventilating towers of Plant No. 3 of the Aluminum Company of America, and next to it the old Acker Process stack rises skyward, indicating the site of the activities of the Niagara Pulp Board Company. Flour mills, pulp mills and other structures merge in the dark buildings further to the right, the row of lights and ventilating shaft denoting and marking Plant No. 2 of the Aluminum Company of America. There is a wonderful wealth of electrical activity and industry in this single photographic reproduction from Niagara. It is of international interest and moment, as it portrays the locality adjacent to wonderful electrical installations, in connection with which we must make mention of the fact that looking through the steel net work of the bridge the glow of Station No. 3 of the Niagara Falls Hydraulic Power & Manufacturing Company may be seen in the picture.



Industrial Power



ELECTRICALLY DRIVEN PUMPS.—III.

THE DEVELOPMENT OF CENTRIFUGAL PUMPS.[1]

The centrifugal pump is very simple in construction, consisting fundamentally of a shaft, two bearings, and one or more impellers mounted on the shaft. This, with the flexible couplings and driving apparatus makes up the complete machine. The first cost of installation, not only of the machine itself but of the foundations and buildings necessary is always considerably less than for other pumping machinery of the same economy. The absence of large-sized packing and of the necessity of frequent packing, the small cost for lubrication, the small cost of repairs, a minimum cost for attendance—all these considerations, while they may not necessarily mean that the centrifugal type of pump is the one to install in all cases, are sufficient to warrant a ful investigation of this type before any installation is made.

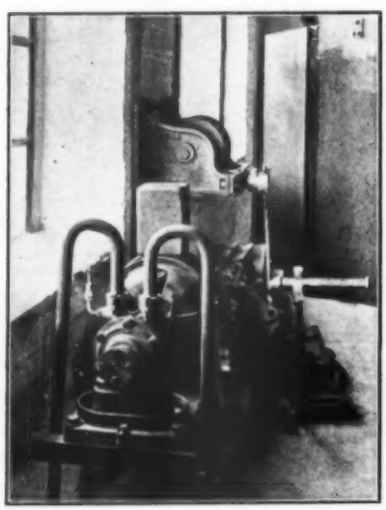


FIG. 12.—AUTOMATIC HOUSE-PUMPING SET, BY THE SIEMENS SCHUCKERTWERKE, GERMANY.

In the early days, before the introduction of a high-speed, economical drive, the use of centrifugal pumps was restricted to conditions of low lift, say from ten to sixty feet. Inasmuch as in waterworks for towns and mills, heads varying from 100 to 700 feet must be produced, it can easily be seen why the centrifugal pump was not then a matter of interest to waterworks and mill engineers except in cases of low lift, filtration or condenser work. However, with the introduction of the steam turbine and reliable, high speed motors, this condition has ceased to exist.

A consideration of the result of the development of centrifugal pumps, might be considered more interesting than the history of this development.

With the ordinary old open type of impeller, efficiencies of from fifty-five to thirty-five per cent and sometimes as low as twenty per cent were obtained. This was natural as practically no attention was paid to correct design, and one shape of impeller vane was made to work under a great variety of conditions. It was also not very important to attempt to get higher efficiencies as these pumps were usually of small capacity against low head, and five or ten per cent better efficiency did not mean a great saving in the power requirements. However, as larger quantities had to be handled against greater heads, then the five or ten per cent or even one or two per cent better efficiency considerably affected the annual coal bill and it became necessary to look closer to proper design.

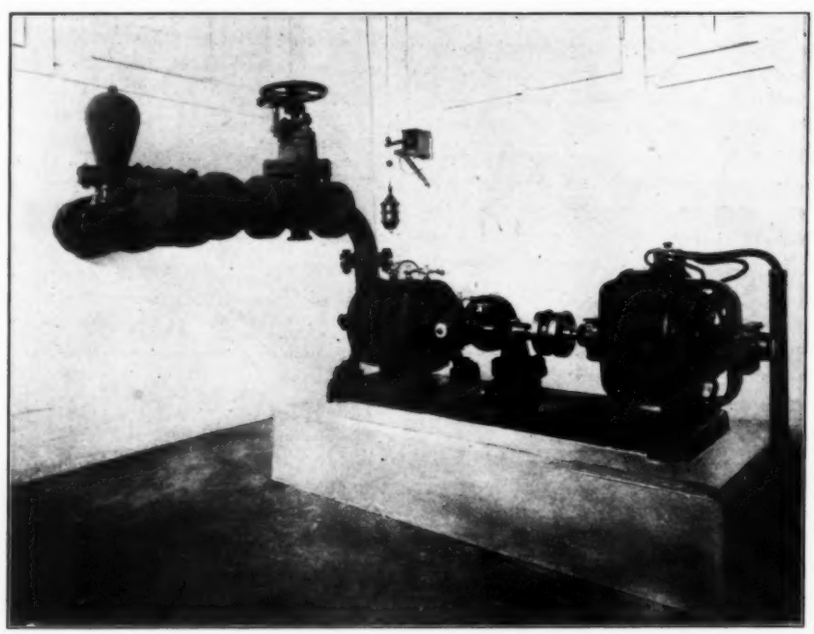


FIG. 13.—MINE PUMPING INSTALLATION AT BODENWOHR, GERMANY—BY THE SIEMENS SCHUCKERTWERKE.

The requirements to be met by all pumping machinery, in these later years, have become more exacting as the questions of efficiency and cost of operation have been investigated. Formerly, if a manufacturer were asked for a pump to have a capacity of 3,000,000 gallons of water against a head of sixty feet, and he had a pump which was designed for a capacity of 3,000,000 gallons per day against forty-five feet, very likely the same pump would be used and the speed increased if possible, to obtain the higher head. This

1 Abstract of a paper by J. D. Berg, (vice-president of the Dravo-Doyle Company, Pittsburg), presented at the convention of the Central States Water Works Association, Columbus, Ohio, Septebmer 28, 1909.

naturally meant that the efficiency obtainable at the higher head was not as high as with a pump designed to suit the conditions. There was also the consideration that when the pump was installed, it would likely be found that the head was either fifty or seventy feet, which would still further work against the pump efficiency.

These facts are recognized by pump manufacturers today and means are taken for the elimination of former troubles. The leading manufacturers now do not merely take the word of the man who is going to install the pump that his pressure is a certain amount, but study the conditions thoroughly before submitting a proposition. Furthermore, after the conditions have been gone into thoroughly, a design is worked out by the engineering department, with the result that in the majority of cases, an entirely new impeller is laid out for these particular conditions, and in some cases even a new casing is needed to suit them.

It is understood of course that a centrifugal pump adds energy to the water by increasing its velocity, which velocity energy is afterwards transformed into pressure energy. The peripheral velocity of the impeller determines the pressure which can be produced. The peripheral velocity can be increased either by increasing the diameter of the impeller, or by increasing the speed. The limit of the diameter of an impeller is soon reached on account of the longer water passages which produce excessive friction and decrease the efficiency. The problem therefore, ordinarily reduces to one of increasing the revolutions per minute. This was done at first by belt driving the pump, but the troubles incident to belt drive retarded the natural development of the centrifugal pump. Direct connection is preferable and as stated before, the steam turbine and high-speed motor supplied that which was necessary to give its development the proper impetus.

Compounding pumps, mounting more than one impeller on the same shaft, with water passages arranged for discharging from one impeller to the suction opening of the next impeller, together with the possibility of obtaining high speed, have made it possible to obtain any pressure with a centrifugal pump that can be obtained with other types.

This is not all that is necessary, however. The question of doing this efficiently is the important one. If it were possible merely by mathematical calculation, to determine the proper design of a centrifugal pump for maximum efficiency, its use would be much more general than is now the case. In no problem of engineering, except possibly that of producing air pressure by means of a centrifugal blower, do experiments and tests play such an important part. Mathematical calculations from the result of experiments are important, but without the tests a designer is completely at sea. But, a first-class pump manufacturer, having the result of a great number of tests on his designs, can develop pumps for new conditions with great accuracy.

As an example of the development of centrifugal pump design, and ability to use empirical formulas intelligently, it might be stated that it is now not only possible to get a guarantee of efficiency together with one of capacity at a cer-

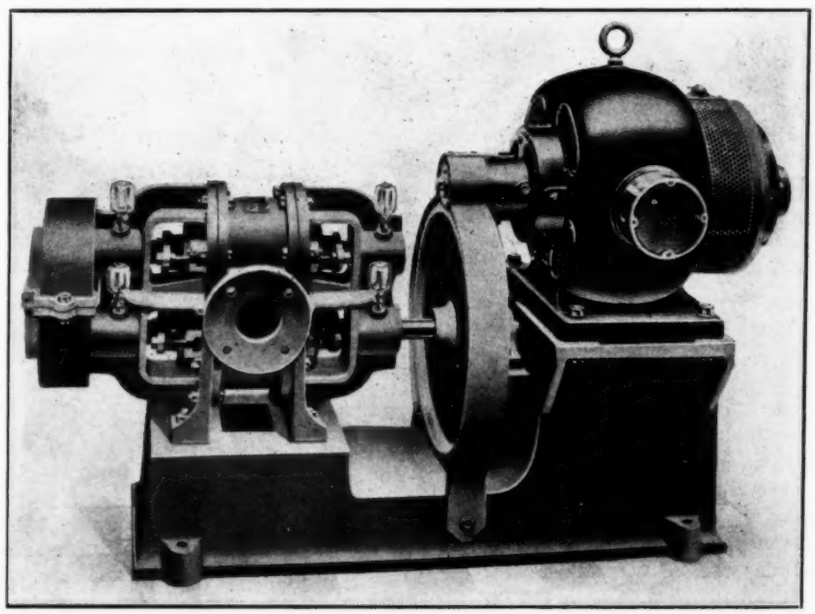


FIG. 14.—MOTOR-DRIVEN PUMPING SET, BY THE DRUM ENGINEERING COMPANY, BRADFORD, ENGLAND.

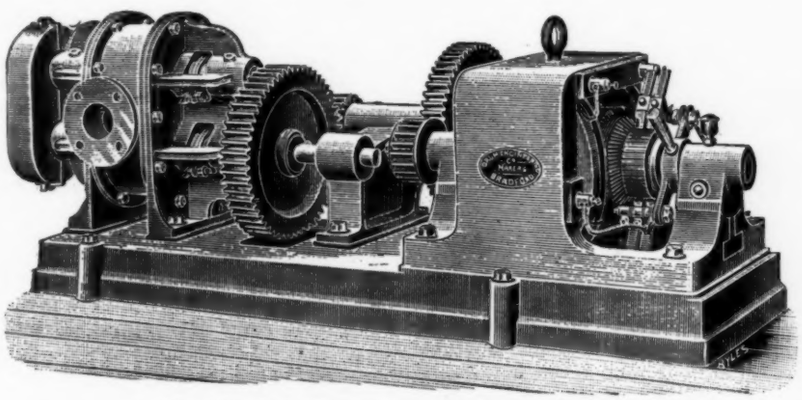


FIG. 15.—HIGH-SPEED MOTOR-DRIVEN "DRUM" PUMP.

FIG. 16.—SECTION OF "DRUM" PUMP.

tain definite head, for centrifugal pumps, but it is also possible to determine, before the pump is built, what the shape of its curve of characteristic performance will be, i. e., how the capacity will vary with varying heads at constant speed or at varying speed. This is an important advancement, as pumps, especially on city work, usually do not work at a constant pressure, and it is often desirable to know what the capacity will be at say, ten or fifteen per cent increased or decreased pressure.

It is also possible to get any shape of characteristic which might be desirable. In some cases the water is pumped into the bottom of a standpipe. This means that when an extraordinary demand for water is placed on the system, the level of the water will fall. It is at this time that it is desirable that the pumps discharge as much water as possible, and at constant speed a centrifugal pump will actually discharge more water at decreased heads. This makes the standpipe as an automatic governor on the system. The centrifugal pump has been developed to the point that the designer can predetermine almost exactly what capacity will be discharged at varying heads. It can be definitely guaranteed that the driving apparatus will not be overloaded, regardless of whether the discharge head is increased or decreased. This is one of the most important developments that have been made in pump design, as the old type of pump and, in fact, most pumps being manufactured today will overload the driving apparatus, some on the head being increased, and some on its being decreased from the normal point.

It can easily be shown that for standpipe service, a characteristic curve having a shut-off pressure considerably higher than the working pressure should be used. This in order to take advantage to the fullest extent of that ability of the centrifugal pump to discharge an increased capacity of water against a decreased head.

Again, when the water is pumped directly into the main, it is desirable to have as flat a characteristic curve as possible in order that when the demand is not great, the pressure will not run up dangerously. When the attempt was first made to obtain this type of characteristic curve, great trouble was experienced from the fact mentioned above, that is, on decreased heads the driving apparatus would be overloaded. This point has been so thoroughly investigated and experimented upon by several pump manufacturers that now with a pump having say a capacity of 3,000,000 gallons of water per day against 150 pounds pressure, if the discharge line should be broken right at the pump, the power required to drive the pump under these conditions would be less than that required at 150 pounds pressure. These problems, while they may be considered trivial to the ordinary investigator, are the ones which have taken longer for solution than might be supposed would be necessary, and the solution of which has done much toward the commercial adaptation of centrifugal pumps to all classes of work.

The details of construction have been improved remarkably as centrifugal pumps have come into more general use. On almost all first-class pumps, bronze instead of cast-iron impellers are now used. All points at which there is a possibility of wear are protected by small removable parts which makes the upkeep small. The present day centrifugal pump is built for hard, rough service, being made much heavier and more substantial than formerly. This development was mainly the result of using the pump for mill service, which is conceded to be as severe as there is. Demands of this service have made the interior working parts more accessible for quick repairs. The separation of the bearings from the case, splitting the bearings, and the glands, etc., while possibly peculiar to only a few pump manufacturers, mark a development in centrifugal pumps which has done much to reduce the operating cost and so has increased its popularity.

It can safely be stated that a centrifugal pump, either motor or turbine driven, can be used on any service where direct-acting pumps are used. This statement is not meant to imply that it is always advisable to install centrifugal pumps, as there are some conditions which can be met better by direct-acting pumps. However, it would seem that a prospective purchaser should approach the subject with the idea of investigating all types, and then decide after he has compared all the data, which type suits his conditions better. It may be that for one set of conditions, a direct-acting steam pump is preferable, while under other conditions a motor-driven centrifugal pump may be preferable.

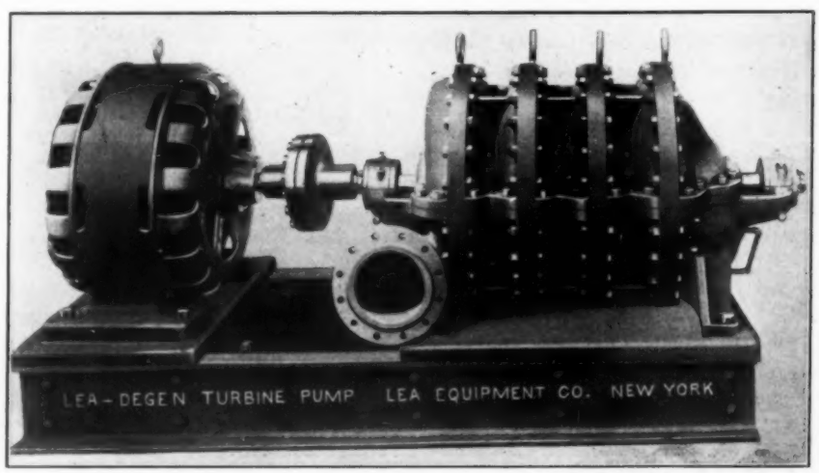


FIG. 17.—MOTOR-DRIVEN TURBINE PUMP.

To show what widely varying conditions can be met successfully by centrifugal pumps, and the extent to which these pumps have been adopted by industrial concerns, the partial record of installations in one of the large cities of the United States might be considered with profit. At three of the larger manufacturing plants alone in this city, there are installed two pumps having a total capacity of 14,000,000 gallons of water per day against a total head of twenty feet; one pump having a capacity of a little over 9,000,000 gallons per day against a total head of thirty-seven feet; one pump having a capacity of 9,000,000 gallons against a total head of sixty feet; one pump having a capacity of 40,000,000 gallons against a total head of forty-six feet; one pump having a capacity of either 40,000,000 gallons against a to-

tal head of forty-six feet or 16,500,000 gallons against a total head of 120 feet; three pumps having a combined capacity of 31,500,000 gallons of water per day against a total head of 120 feet; one pump having a capacity of 18,000,000 gallons against a total head of 106 feet; one pump having a capacity of 15,000,000 gallons of water per day against a total head of 126 feet; two pumps having a combined capacity of 20,000,000 gallons of water per day against a total head of eighty feet; two pumps having a combined capacity of 12,000,000 gallons of water per day against a total head of 110 feet.

We understand that one pump manufacturer is at the present time building a pump to have a capacity of 1,000,000 gallons of water per day against a total head of 1,400 feet.

In one industrial plant in Ohio, there

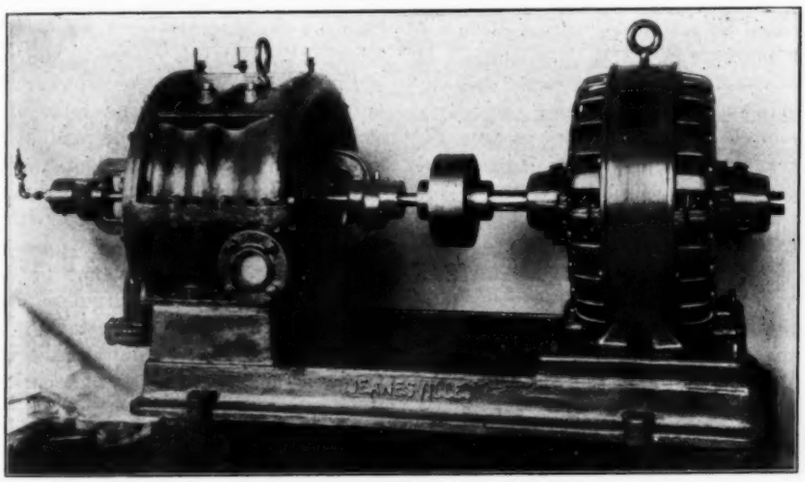


FIG. 18.—JEANESVILLE PUMP AND WESTINGHOUSE MOTOR.

are installed the following pumps: One 20,000,000-gallon forty-foot pump; three pumps having a combined capacity of 30,000,000 gallons against a head of fifty feet; and four having a combined capacity of 52,500,000 gallons against 120 feet. We understand that one of these pumps ran for over seven months, being shut down in that time only once for twenty minutes.

A town in southern Kentucky has an interesting installation of turbine-driven centrifugal pumps. It consists of two 110-horsepower and one 300-horsepower machines. One of the smaller machines supplies the sedimentation basins with raw water from the Ohio River. The other 110-horsepower machine supplies 4,000,000 gallons of water per day against a total head of 115 feet for domestic service. This pump is also arranged for supplying 2,000,000 gallons of water per day against a total head of 231 feet for fire service. The 300-horsepower machine supplies 6,000,000 gallons against a total head of 231 feet for fire service, which gives a total fire capacity of 8,000,000 gallons of water per day against 100 pounds pressure. The 300-horsepower machine is also run on domestic service at times, under which condition it is run at a lower speed. The duty of the larger machine on domestic service, low speed, is almost the same as that of the 110-horsepower machine, which makes it an excellent spare for the system.

A city in Indiana has a power canal with approximately twenty-eight-feet head available. Formerly, part of the water for this city was pumped by means of direct-acting pumps, geared to water motors. About eighteen months ago a four-stage twelve-inch centrifugal pump was installed. This pump was direct connected to a pair of water turbines, running at speeds varying from 350 to 550 revolutions per minute. The pump is required to work against either 200 or 300 foot head, the lower pressure being for domestic service, and the higher pressure for fire service. The installation we understand proved so satisfactory that they are now installing an additional machine, and are having a third machine built.

A city in Virginia has installed four 4,000,000-gallon pumps, to work against a total head of 168 feet. Each of these pumps is direct-connected to a 200-horsepower alternating current induction motor, running at a speed of 885 revolutions per minute. Under these conditions, which ordinarily would not be considered good for a centrifugal pump at all, an efficiency considerably better than seventy per cent was obtained on test. These pumps have not been running a year, and it will be interesting to ascertain the cost for attendance and upkeep.

Besides the installations mentioned above, a great number of installations for fire service have been made in the last year or so.

One field where motor-driven centrifugal pumps have been used to good advantage in town waterworks is that of booster service for outlying districts. There have been several installations made of this character and they have proven very successful. In one case which has been brought to our attention, two pumps were installed, each having a capacity of 1,000,000 gallons per day against a total head of eighty-eight feet. It will be understood of course, that regardless of the pressure which exists on the suction side of these pumps, they add eighty-eight feet to this pressure. As they are driven by alternating-current induction motors, the operation of which is very simple, and as there are only ring-oiled bearings on the entire apparatus, they required a minimum amount of attention and are really the most satisfactory pumps which could be installed for this service. It would seem there is a large field for the use of these pumps for producing fire pressure in outlying districts, where, on account of excessive friction in existing lines, it is necessary to raise the pressure at the main station a great deal higher than would be necessary if the lines were of the proper size. A plan, which has been suggested in some cases, is to install several of these pumps in outlying districts and so arrange them that when only domestic service is required in the district the water will be by-passed around the pump. A check valve opening in the direction of flow would be installed in the by-pass and another between the pump discharge and the line. Upon an alarm of fire being sent in, the motor can be started from the main station, and on account of the greater pressure on the discharge side of the pump, the check valve in the by-pass will be closed and the pressure boosted the proper amount.

(To be continued.)

ELECTRICAL Advertising *and* Selling

ADVANTAGES OF ELECTRIC DRIVE.

ARGUMENTS FOR THE POWER SOLICITOR.

BY J. E. BULLARD.

No lawyer will think of going into court and defending his client without first very carefully analyzing the case and if it is a criminal one finding the motive for the crime. No physician will prescribe medicine or treatment without first diagnosing and deciding upon the nature of the disease. No first class clergyman will prepare or preach a sermon without first very carefully looking over the situation and deciding upon either what the people most desire or what they most need. The up-to-date power solicitor to be the most successful in his line must be a combination of these three professions. His prospect will be a composite of client, patient and congregation, for whom he must analyze and finding the motive for using power, whose disease—cheap power—he must diagnose and prescribe for, and to whom he must preach the sermon of progress.

Let us analyze the power problem. First; what is the motive for, or why did manufacturers first use power? Second; what is the real object of using power? Third; what is the best way to attain this object? In order to answer these questions it is best to go back in the history of manufacturing. In doing so we find that each article was originally made by hand and that one person did all the work from collecting the raw material to putting the finishing touches on the finished product. Let us take a concrete case.

I knew a man who used to be a cooper. He would go into the forest and cut his timber. With his own team of oxen he hauled it to his little workshop where he sawed it up, split it into staves and made his pails. Later he found that he could make pails cheaper by hiring several men and giving each man some particular part to do. After a time this became too expensive so he built a little factory on the bank of a stream, installed a water wheel, and did part of the work by machinery. As the number of pails made increased even this became too expensive. The water was too unreliable. In summer it was low and in winter ice often stopped the wheel. This necessitated doing a great deal of work by hand that, when the power was on, could be done by machinery. For this reason he built a steam plant so that when he could not use water he could use steam. As business increased he completely outgrew the water power and, as he was obliged to use steam all the year round and depended less and less upon the water, he built a larger factory nearer the market for his pails and, utilizing the waste for fuel, ran it entirely by steam. As machinery was introduced for more and more operations, and he began to dry all his staves and headings in a dry kiln instead of by the sun in a large yard, the demand for fuel became so great that his waste did not supply enough and he had to buy coal. Another increase in the factory became necessary. After a careful consideration of the matter from all points of view he decided to run his new factory by means of electric motors and buy his electricity from the central station doing business in the town where he had established his new factory. He was influenced to take this step by two reasons: First, it made the power problem even simpler than it was when he was using water power. He no longer had to depend on an engineer who might get sick or get drunk and close down the whole factory for a few hours or a few days. He decided that when he was in a bad humor he could cuss the power company to his heart's content without the slightest danger of losing a good engineer. He no longer had any low water or ice troubles and as much or as little power as he desired was delivered to him when he needed it. The motors required even less attendance than did the water wheel and as they could be placed on the ceiling, wall or floor occupied little space and allowed him to arrange his machinery to the very best advantage. Second, and perhaps in his case the deciding reason, electricity greatly reduced the fire hazard and very materially lowered the fire insurance rate.

This little history shows very plainly that this man used power because it was too expensive to make pails by hand. In other words he used it in order to make more pails at a lower cost. He used it in order to enable each man to make more pails in a day than he could possibly make in any other way. For this reason he did not continue to use the cheapest power but put in a steam plant and later used electricity. Each time he was using a more expensive power than he had ever used before. Each time, nevertheless, he was cheapening production. We see then that he used power to cheapen production and that he did this by increasing the output of each man. The way that he attained his end was by using the power that was the most flexible, the one that carried the smallest fixed charges and the one that was the most constant and dependable besides requiring the least superintendence.

We now have the answers to our three questions. First, the motive for using power is to make more goods at a lower cost. Second, the real object of using power is to cheapen production by increasing the productiveness of labor. Third, the best way to attain this object is to use the power that causes the least trouble, the one that is most flexible and the one that will enable the worker to turn out the greatest possible amount of work. It is very clear that the cost is the last and the least important item to be considered.

A prospect knows that power is used to cheapen production. He knows that the power and the labor costs are the only ones easily changed. He knows that they depend a great deal upon each other. He believes that if he can lower his power cost he will thereby

decrease his production cost. Upon investigation he finds that his power cost is only five per cent while his labor cost is thirty-five per cent of his production cost. His raw material he finds to be thirty per cent and fixed charges, office and selling expenses thirty per cent. These figures tell a very instructive story yet this man is still certain that it pays best to reduce his power cost even at the expense of labor. In fact he is seriously considering the installation of a system requiring a large original investment. It has not been used sufficiently long to have proven its reliability and efficiency from the manufacturers' point of view yet it will without doubt make a horsepower cheaper than it can be made by any other known method. There, however, is a great danger that it will not be constant and reliable and that it will greatly increase the labor cost.

Let us give this man a little mental massage treatment by means of a few figures. We will take as an example the pail factory mentioned above, assuming that it costs a dollar to make a pail. Then, according to our figures, it takes five cents of power, thirty-five cents of labor, thirty cents of raw material and thirty cents of fixed charges, office and selling expenses. We will say that there are ten men and that they make 100 pails a day. Then our total expenses are $5 for power, $35 for labor, $30 for raw material and $30 for fixed charges, office and selling expenses: a total of $100. We will increase the power cost from $5 to $6 a day. Now the same men because of a more constant supply and a steadier speed make 110 pails a day. All the daily expenses except those for power and raw material remain the same. We have $6 for power, $35 for labor, $33 for raw material, $30 for fixed charges, office and selling expenses, a total of $104 a day, but 110 pails. The power cost per pail is $6 divided by 110 or five and five-elevenths cents, the labor cost is $35 divided by 110 or thirty-one and nine-elevenths cents, raw material is still thirty cents while fixed charges, office and selling expenses are $30 divided by 110 or twenty-seven and three-elevenths cents. Adding these together we find that each pail costs ninety-four and six-elevenths cents. In other words by increasing the power cost per pail about one-half cent we have reduced the total cost over five cents. We will work out the proposed method in the same way. The power cost is $4 a day but the inconstant speed and the unreliable supply causes the same men to reduce their daily output to ninety pails. Our daily expenses are now $4 for power, $35 for labor, $27 for raw material, $30 for fixed charges, office and selling expenses, a total of $96 or a saving of $4 against the former increase of $4. Let us see if the pails cost less. The power is $4 divided by ninety or four and four-ninths cents, the labor is $35 divided by ninety or thirty-eight and eight-ninths cents, raw material is still thirty cents, fixed charges, office and selling expenses are $30 divided by ninety or thirty-three and three-ninths cents. Adding these together we find that each pail now costs $1.06. In other words we have reduced the power cost about one-half cent and increased the total cost over six cents per pail. This makes it plain even to a man with a dormant or nearly dead reasoning faculty that it is not safe to blindly reduce the power cost but that all sides of the question must be carefully considered before any changes are made.

Progress appeals more to a man's faith than to his reason. Therefore, we have to preach, not argue it. We will take up progress under the three heads—cleanliness, light and system. Cleanliness being next to godliness we will consider first. Standing a little while in an average machine shop and getting a big drop of oil down your neck will demonstrate that there is opportunity in that shop for great improvement along the line of cleanliness. Put on good clean clothes and, if you are constituted like the ordinary man, standing in close proximity to and looking at the unsightly, dangerous and rapidly moving conglomeration of belts and shafting will cause a creepy sensation to come over you. The gloom and filth in which many men have to work day after day cannot help having a depressing effect upon them. Observation will show that the men who work in the cleaner places at least appear to be more cheerful, happy and contented and even to work faster. I have never yet passed through a machine shop and seen the men working so rapidly as they do in a shoe or a box factory where the surroundings are cleaner. If the machines in a machine shop are painted white and carefully cleaned every day; if all the belts and shafting are eliminated by using individual electric drive; if the floors are kept absolutely clean by a conscientious janitor we have a far cleaner and more inviting place than is the ordinary shop or factory.

All oil, soda water, etc., used in the various operations of machining or for lubricating the machines should be carried by pipes to central reservoirs. There it should be filtered and pumped back to the machines. With a motor installation this can be done automatically, thereby saving power, attendance and materials. Every grinder and polisher should have a hood connected to an exhaust system over it in order that as far as possible all the dust will be carried away. That dirtiest of all metals to work—cast iron—will lose some of its grime if a hood containing a good strong vacuum is placed directly over the cut so that all the fine dust so disagreeable to the operator will be carried away. Exhaust systems can be installed and operated by motors arranged to automatically maintain a perfectly uniform vacuum at any required number of inches. I believe that the time will come when every shop and factory will have to be better ventilated than any of them are today. I believe that every machine that in the course of its operation throws off any dust, lint, fumes or anything that is detrimental to the health of the operator will have to be provided with a hood to take away all these undesirable elements. It is comparatively easy to do all this and it can be done best and most economically by means of electric power.

If there is anything that will help solve the slum problem it is making every place men or women work the model of cleanliness. This will tend to make them cleaner at home. When that rasping feel in the throat caused by continually breathing the dust of the shop or factory is no longer felt one of the best excuses of intemperance will be gone and all laborers and mechanics will live a saner and a cleaner life.

It would seem that anything used so little but so important when it is used as light would never be reduced to the low standard common in factories and shops. In fact in some places the light is so poor the men can not do a real good job after dark and what

little work they do manage to do is done at a far slower rate than in the day time. The strangest part of it all is that the managers of these plants are certain they are running them in the most economical way. The windows are patched with boards and sheet iron and seldom washed. The walls are of a dark grimy color and there is scarcely any general illumination. This manager is usually the same one who has the cheap power disease and the treatment given him for that will also help cure this complication. If he will keep his windows glazed and clean, paint everything white and use individual motor drive, it is very possible that the energy now used for light will give enough so that the output per man will be increased twenty per cent during the hours artificial illumination is required. In any case from what has gone before it is clear that anything that bears so small a relation to the total expense of production but is so important to the efficiency of labor cannot safely be neglected. It is far cheaper to use too much rather than too little. In fact high light bills are nearly always cheaper than low ones.

Nowadays we hear a great deal about system but often it would appear that the person who talks the most about it does not know what the word, as it is used in modern business, means. Everything is being systematized—office, shop and selling force. Several magazines have sprung up entirely devoted to system and we ask. What does it all mean? It simply means that we are trying to accomplish more with less labor. The word system as we now use it may be best defined as the method for getting the greatest results with the least labor. The best shop system can be attained only by using electric motors either with small group or individual drive. This is due to the fact that all other powers are too rigid and the layout must be made from the power rather than the labor point of view. A systematic shop is one where the raw material comes in at one end and goes from machine to machine with the smallest possible amount of handling or conveying till it comes out at the other end a finished product. It is next to impossible to economically arrange all shops in this manner with any of the old systems of power. With electric power it becomes easy and provides a vast and fertile field for the wide-awake power solicitor.

Summing up our sermon we find that to be progressive we must look into the matter of cleanliness, light and system. In order to make the surroundings the cleanest we must use individual electric drive. In order to make them the brightest we must use electric power. In order to have system we are forced to use electric power. In short electricity spells progress and all progressive manufacturers must utilize electric power.

In conclusion we find that taken from the viewpoint of the lawyer, doctor or minister the arguments are strongest in favor of electric power and against the use of steam, water, gas, wind or any other form with which mankind is familiar. It appears then that it is only a case of analyzing, prescribing and preaching to get all power users who do not die too soon to use electricity. Let all of us forget about the cost of power and talk cost of production and progress. Let us mix with this talk, enthusiasm, energy, persistence, judgment and integrity and make the most of every minute and see what we can accomplish.

An Active Central Station.

Recent reports from St. Louis, Mo., convey the idea that the Union Electric Light and Power Company, of that city, may be numbered among the central stations who are actually "doing things." According to Alten S. Miller, general manager, this central station is going to get acquainted with the public and get the public acquainted with the company. Mr. Miller has been in charge of affairs in St. Louis for about four months and recently began a series of advertisements by which he expects to set the people of St. Louis thinking about the problem the company has to solve properly, namely, to serve its customers.

The new general manager believes in publicity and close friendship with customers. He invites the public to kick—and make it strong. "But kick to the company and don't worry your neighbors about it by a back fence complaint circle," is his advice.

The first step Mr. Miller made to make the way of the complainers easy was to tear out the series of formidable corridors and partitions in the company's headquarters which ruffled the tempers of patrons with a kick. It is no longer necessary to get lost in these extensive boarded alleyways while looking for someone to receive a complaint.

An open court has now taken the place of the long boarded enclosures, and a large electric sign saying "Complaints" points the way to the complaint department. Before Mr. Miller's advent a small sign saying "Information" directed the man with a complaint to the series of corridors about the various departments.

As laid out at present Mr. Kicker walks into the larger outer court, and chooses his department at a glance. He can no longer argue that if he had no legitimate complaint before he entered the building, the dark, mysterious hallways made him have a kick before he found the person he was looking for.

The series of get-acquainted advertisements grasp the attention of the readers with such headlines as "Electricity in Packages," "Why We Use the Streets," "Forced Investments," "Complaints," and "Competition."

Once each week for the next three months Mr. Miller expects to use these advertisements to make the people think.

"Get in touch with the people and tell them the truth," is his motto. Mr. Miller says: "We cannot live without customers. A satisfied patron is an asset of any company. A dissatisfied consumer can create more of a stir than forty pleased customers who forget to take the time to tell their neighbors about it. The man with the complaint can throw a lot of brickbats, and we want to stop the brick throwing once and for all.

"We make mistakes. Every company does. Every business man does. We want to correct our errors, and invite complaints so that we can have an opportunity to satisfy them. We are selling service more than electric current."

One Form of Advertising.

The Beloit Water, Gas and Electric Company recently erected an arch over State Street, Beloit, Wis., in front of its offices. This arch is equipped with forty-six, two-candlepower lamps and is an attractive addition to the electric display already constructed by the company.

It is understood to be the idea of the company to try to interest the merchants of the city in erecting a number of these arches over the streets in the business portion of the town.

FINANCIAL REPORTS OF ELECTRIC COMPANIES.

NEW YORK TRACTIONS.

The New York Public Service Commission has issued the following statement in connection with passenger traffic and revenues derived from operation of traction lines in New York during the month of October, 1909:

	Fare Pass. Oct., 1909	Fare Pass. Oct., 1908	Tot. Rev. from St. Ry. Op.
Entirely underground or elevated	52,587,156	45,195,707	$2,706,788
Hudson & Manhattan	3,442,841	1,132,563	179,364
Interborough R. T.—			
Subway div.	23,489,467	25,235,478	1,214,340
Elevated div.	25,654,748	23,827,666	1,313,083
Brooklyn R T system	34,581,857	31,512,020	1,774,322
Brooklyn Hgts.	12,917,457	11,873,728	646,958
Brooklyn, Q. Co. & Sub.	2,214,454	2,083,040	114,710
Brooklyn Union Elevated	11,763,017	10,827,877	614,121
Coney Island & Gravesend	34,420	35,788	2,054
Nassau Electric	7,201,638	6,359,325	368,578
Sea Beach	145,190	92,830	8,013
So. Brooklyn	305,681	239,432	19,886
Metro. St. Ry. system	26,336,650	24,541,233	1,339,395
Metrop. St. receivers	23,886,506	23,615,447	1,209,036
Second Ave. receiver	1,430,342	†	76,722
28th & 29th Sts. Crosstown, receiver	27,175	†	1,383
Cen. Pk., N. & E. River	992,627	925,786	52,251
*Third Ave. RR system	11,863,345	11,102,852	663,959
Dry Dock, E. Bdway & Battery, receiver	938,774	934,150	53,498
42nd St. M. & St. N. Ave., recvr.	2,447,740	2,206,315	125,005
So. Boulevard	165,050	131,717	8,252
Third Ave. receiver	4,168,455	3,842,292	266,271
Union of N. Y. receiver	3,323,413	3,293,281	169,771
Westchester Elec. receiver	819,913	695,097	41,160
Minor companies	5,469,265	5,094,516	269,830
The Bronx:			
City Island (horse)	14,763	N. R.	675
Pelham Park (horse)	17,703	N. R.	874
N. Y. City Interborough	343,605	257,588	15,821
Brooklyn:			
Coney Island & Brooklyn	2,335,933	2,287,254	113,841
Van Buren St. & Erie B.	131,190	138,803	3,772
Queens:			
L. I. Electric	273,759	258,869	15,508
N. Y. & L. I. Traction	629,023	548,016	31,782
N. Y. & Queens Co.	1,647,748	1,527,795	83,345
Ocean Electric	75,541	76,227	4,264
Grand total	130,838,273	117,346,328	$6,754,295

* Yonkers Railroad not included. The Kingsbridge is included in the Third Avenue operations and the Bronx Traction in the Union Railway Company.

† Operated by the Metropolitan Street Railway during September, 1908.

ASSOCIATED BELL OPERATING COMPANIES.

The American Telephone and Telegraph Company announces the following earnings statement of the Associated Bell Operating Companies in the United States, not including the long-distance lines of the American Telephone and Telegraph Company. The following are the data first for the month of November, 1909, and then for the eleven months ending with November 30. In each case the figures are compared with corresponding periods in 1908:

	Nov. 1908.	Nov. 1909.
Gross Earnings	$10,769,662	$11,788,696
Expenses Operation	$4,104,130	$4,260,146
Taxes	440,672	514,203
	$4,544,802	$4,774,349
Balance	$6,224,860	$7,014,347
Maintenance & Depreciation	2,914,250	3,639,312
Net earnings	$3,310,610	$3,375,035
Interest	623,638	632,737
Balance	$2,686,972	$2,742,298

	11 Mos. 1908.	11 Mos. 1909.
Gross earnings	$114,284,927	$123,434,320
Expenses Operation	44,536,222	45,264,923
Taxes	4,726,542	5,377,979
	$49,262,764	$50,642,902
Balance	$64,972,163	$72,791,418
Maintenance & depreciation	32,211,676	38,601,906
Net earnings	$32,760,487	$34,190,322
Interest	7,011,954	6,345,649
Balance	$25,748,533	$27,844,673

In 1909 all maintenance and depreciation is charged against expenses monthly instead of being partly provided for by an extraordinary charge in December, as heretofore. In order that a true comparison may be made between 1908 and 1909, the 1908 figures as now presented include in expenses for each month one-twelfth of the extraordinary provision for depreciation which was made in December, 1908. The unexpended portion of the provision made for depreciation for the first eleven months of 1909 was $11,965,019, which is not counted as profits but remains as a reserve for future replacements.

UNITED RAILWAYS INVESTMENT COMPANY.

The United Railways Investment Company reports to the New York Stock Exchange for ten months ended October 31, 1909, as follows:

INCOME.

Dividends on stocks owned	$1,560,672	
Interests, loans, accounts received, etc.	37,892	
		$1,598,564

DEDUCTIONS.

Expenses, taxes, etc.	$ 53,212	
Interest on bonds, etc.	1,059,685	
		$1,112,897
Net income for period		$ 485,667
Previous surplus		1,089,961
Surplus October 31, 1909		$1,575,628

METROPOLITAN LINES SHOW A NET GAIN.

The receivers of the Metropolitan Street Railway have given out a condensed statement of income covering the operation of the road for the six months ended December 31, 1909, in comparison with the corresponding period of 1908. A decrease of $89,590 is shown in gross earnings and also a decrease in operating expenses amounting to $1,392,478, which left an increase of $1,302,888 in net earnings for the period.

This increase, according to a footnote, was more than covered by a reduction of maintenance charges for the six months ended December 31, 1909, over the corresponding period of 1908.

The receivers paid $638,378 in taxes and $1,303,708 in interest and rentals. The operating income of the system was $2,247,702 net, and other income amounted to $230,546 for the last six months of 1909. Having deducted payments for taxes, interest and rentals, a surplus not including defaulted charges of $536,164 appeared for the quarter. The figures are as follows:

	Six Months Ended Dec. 31 1909.	Increase Over 1908.
Cash fares	$6,631,623	*$ 89,590
Operating expenses	4,383,921	* 1,392,478
Net earnings from op.	$2,247,702	$1,302,888
Income from other sources.	230,546	* 22,720
Gross income	$2,478,248	$1,280,168
Deductions from income—		
Taxes, including special franchise	$ 638,376	* 74,427
Interest rentals, etc.	1,303,708	* 79,106
Total	$1,942,084	*$ 153,533
Net income, surplus, not including defaulted chgs.	$ 536,164	$1,433,701
Revenue passengers carried.	133,407,007	*1,120,633
Transfer passengers carried.	62,120,091	*3,945,638
Total passengers carried.	195,527,098	*5,075,271

* Decrease.

The statement includes the results from operation of the property of the Central Park, North & East River Railroad Company during the period from July 1 to August 5, 1908, and of the Second Avenue Railroad Company from July 1 to November 12, 1908.

There are included in the above statement in operating expenses all expenditures during the periods covered for rehabilitation of the physical property; also an estimated amount for unsettled claims for injuries and damages.

KEYSTONE TELEPHONE.

The Keystone Telephone Company has issued a statement covering the six months ended December 31, 1909, which compares as follows:

	1909	1908
Gross	$551,052	$528,237
Expenses	274,094	261,778
Net	$276,968	$266,459
Charges and renewal	183,949	206,978
Surplus	$93,018	$59,480

NORTHERN OHIO TRACTION AND LIGHT.

The annual report of the Northern Ohio Traction and Light Company for the year ended December 31, 1909, compares as follows:

	1909	1908
Gross	$2,177,642	$1,890,473
Expenses and taxes	1,190,057	1,086,424
Net	$987,585	$804,049
Charges	524,066	526,532
Surplus	*$463,519	$277,517

*Equal to 4.038 per cent earned on stock.

INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

The Chicago Sales and Display Rooms of the Holophane Company.

No greater exemplification of the rewards of enterprise exists than that shown in the development of the sales, display and testing rooms of the Chicago office of the Holophane Company, located at 298 and 300 Wabash Avenue. Only a few years ago (two years last August) a small office and testing department were established under the direction of C. A. Howe as manager. The Chicago offices now occupy an entire floor with twenty-seven by 167 feet of surface area. The main office and demonstration rooms occupy about twenty-seven by fifty feet, with the general office forming a roomy and pleasant entrance to the display rooms and testing laboratory. The general office is papered in a soft brown paper running to a height of nine feet from the floor. There is a three-foot frieze in cream, the ceiling being finished in the same color. The office is paneled and railed in golden oak, the office furniture harmonizing with this finish. From the twelve-foot ceiling there are suspended six of the new style twelve-inch reflector-bowl units, each of which is equipped with one 100-watt Mazda lamp. There are also two indirect lighting units each equipped with one 150-watt Mazda lamp, shrouded in an art glass bowl.

Adjacent to the general office is a display room, the walls of which are finished in dark green burlap. While a partition cuts down the floor space to about ten by fifteen feet, there is a ceiling display space of fifteen feet square. From the ceiling in this display room there are suspended the following units:

One Holophane cut-glass hemisphere equipped with four forty-watt Mazda lamps. Three single Holophane I, E and F reflectors equipped respectively with 100, 150 and 250-watt Mazda lamps. One steel extensive 100 reflector with one 100-watt Mazda lamp bowl frosted. One each of ten-inch, twelve-inch, fourteen-inch and sixteen-inch reflector-bowl units of the stem and chain type, and Holophane arcs equipped with twenty-five watt, sixty-watt and 100-watt lamps. The latter are exhibited both with the satin glass and clear reflector. There is also shown a four-light Holophane cluster with a three-way switch; a Holophane sphere, a four-light Reflexolier gas fixture, showing the types of intensive and extensive Holophane reflectors for the inverted type of gas mantle. In this display room there is also a mirror top table for the exhibition of cut glass effects, and there is an extensive shelf capacity for the display of standard glassware and steel reflectors.

Adjoining the display room is the testing room and demonstrating laboratory. Here there are three individual testing booths so equipped that the effects of the extensive, intensive and focusing types of reflectors can all be studied at one time. Curtains are arranged so that the testing room can be divided into three distinct rooms, and a clever arrangement of drop cords passing through suspension hooks allows the light units to be suspended at any height above the illuminated plane so that the effect of distribution and intensity can be comparatively studied.

C. A. HOWE, MANAGER CHICAGO OFFICE OF HOLOPHANE COMP...NY.

Each of the booths is wired and equipped with suspension bars so that any type of lamp or reflector can be set up and its characteristics studied. The ceiling of the booths is equipped with frosted bowl and clear Holophane hemispheres of the same relative candlepower, affording an opportunity for the study of the relative distribution and light flux. The booths also contain a full line of steel reflectors mounted on brackets, demonstrating every angle at which these can be used. There are also shown reflectors for window lighting and various decorative effects, and lamps and reflectors for the development of color schemes in decoration display. One particularly noticeable feature in this direction is a large hemisphere equipped with variously colored lamps operating in "skee-doodle" flashing sockets. This gives a continual change of color, effecting an iridescent play of light rays, which makes it peculiarly adaptable for electric fountain and similar display work. One of the booths is equipped to demonstrate the new car-lighting effects, particularly the utilization of the new square reflectors, with various reflecting angles, and the new hemisphere berth lights. The booths are also equipped with hangers for suspending wall coverings of various colors so that the effect of color absorption may be studied. Color cards and materials for studying light quality and commercial effects are also provided for.

Next to the testing laboratory is the east room, ten by twenty-one feet, with a twelve-foot ceiling, which has been papered in a soft brown paper with a three-foot frieze and ceiling in cream. Down the center of this room there are suspension hooks for eight drop lights, the suspension cords being so arranged that a unit of any size can be suspended at any distance up to twelve feet from the illuminated plane. This room will admit of the testing of light sources from a nineteen-foot center down as close as may be desired. Curtains are arranged so that the room may be divided at the center across its smaller dimension so that the intensity of the light distribution may be studied absolutely without any reflected interference from the side walls or ceiling. This room will also be equipped with a machine for demonstrating the compar-

ative illuminating values of bare lamps and lamps equipped with reflectors for factory lighting.

The testing laboratory is equipped with every facility for the actual demonstration of lamp performance, and is entirely at the command of engineers, central-station men, electrical contractors and supply men, architects, or any others who have any lighting problems to solve. The company extends an invitation to anyone interested to utilize these facilities whether for the testing of the Holophane apparatus or for any other type of reflector. There has been a growing appreciation on the part of those interested in lighting problems of these facilities and there is rarely any time during the day when there is not some inquiry received.

GENERAL OFFICE AND RECEPTION ROOM, HOLOPHANE COMPANY, CHICAGO, ILL.

In addition to these display rooms and testing laboratories the Chicago office has a large stock room with a capacity of a little over seven carloads. This includes a bin capacity for a little over a carload, which represents about 250 barrels. A complete stock of standard glassware is always carried on hand, making the facilities for immediate shipment complete.

The manager of the Chicago office is Charles A. Howe, with H. D. Howe as his assistant manager and city salesman. A competent office force is maintained and one always finds some member of it present to assist in planning or testing lighting problems.

Quarry Electrification in Belgium.

It appears that quarry electrification is in a very forward state in the small but industrially well advanced kingdom of Belgium. Upwards of 10,000 horsepower of electricity is utilized in Belgium for the quarrying and dressing of stone.

This is divided up approximately as follows: Actual quarrying: winches, 2,200 horsepower, traveling cranes, 1,500 horsepower. These, together, make thirty-seven per cent of the total. Handling and dressing: traveling cranes, 1,300 horsepower; transporter, 100 horsepower. These total eleven per cent. Pumping piston pumps, 300 horsepower; centrifugal pumps, 900 horsepower. These make up twelve per cent of the total. The balance, thirty-seven per cent of 3,700 horsepower is required for lighting, secondary motors, and reserves.

Some fifty quarry companies are concerned in this phase of exploitation, and one of these generates more electricity than it can use, and sells current not only to other industrial undertakings, but to local authorities. This is an excellent record, and more than one of the installations would well repay inspection by quarry owners and engineers.

A noteworthy feature in some of these quarries is the fine steel girder gantries with electrical conveying appliances.

Telephone Train Dispatching for the Gulf, Texas & Western Railroad.

The Gulf, Texas & Western Railroad is installing the telephone for train dispatching on its line between Jacksboro and Benjamin, Texas. This is a new road, located to the northwest of Fort Worth and joining the Chicago, Rock Island & Gulf and the Wichita Valley Railroads at Jacksboro and Seymour. The line is 105 miles long and has adopted the most modern method of handling its trains by telephone.

The telephone apparatus was purchased from the Western Electric Company, manufacturers of the standard "Bell" telephones used by the entire Bell system. The example of this road is one being followed now by many short lines under construction, as the telephone has simplified the operation of the roads to such an extent that the problem of opening a new line in a hitherto undeveloped country is made easier, especially for operating officials.

Rubber Importation for 1909.

Another record for quantity of material consumed by electrical and other trades has been broken by the enormous importation of india rubber during the past year. The importation, including "balata," gutta-percha, and "gutta-joolatong," reached a total of more than $62,000,000, which exceeded the previous high record by six million dollars.

The marked and steady growth of the rubber industry has followed closely after the development of the electrical industries and may be taken as an indication of the advances made in this line.

A Combined Tumbler Switch and Circuit Breaker.

An automatic tumbler switch, which is claimed to be the smallest circuit breaker in the world, has been designed and patented by C. W. Denny, of London, England. It is suitable for conduit wiring systems. The switch, which is a slight modification of the standard five-ampere tumbler switch, is mounted directly on top of a small pot magnet, the winding of which is in series with the switch. The magnet is supplied with a circular keeper or armature, which in turn operates a rocking lever in the switch. Projecting through the porcelain switch base is a push-button, which also engages with the said rocking lever. In closing the switch, the

operating lever or knob is pulled down in the ordinary manner; this pushes the contact blade home. The operating knob then returns to the "off," or starting, position. The contact blades are retained in position by a small catch attached to the extreme end of the rocking lever. Should it be desirable to open the switch by hand, the push-button is pressed, and the rocking lever tilted, and the switch blades released. On the other hand, should the current passing through the switch exceed a predetermined value, the armature is attracted towards the magnet, and the rocking lever is again operated, and the switch blades released.

The object of this switch is to eliminate as far as possible the use of fuses on lighting and small power circuits, and it can be used either for controlling lights from a distribution-board or from separate points.

Great Northern Railway Dispatches Trains by Telephone Over 2,100 Miles of Line.

The equipment of the Spokane Division of the Great Northern Railway with telephone train dispatching apparatus will complete a total of 2,100 miles of line which this road is now operating in this manner.

The Spokane Division extends from Troy, Mont., to Leavenworth, Wash., a distance of 337 miles. On account of the length of this division, and the amount of traffic passing over it, two dispatchers are required to handle the division. They will have on their dispatching circuits forty-five way stations equipped with standard Western Electric telephones and Gill selectors.

The standardization of this apparatus for the railroads of the country has included a testing device which is installed throughout the Great Northern system. This is a panel somewhat similar to the well-known telegraph peg-board, but containing telephone jacks and plugs. The circuits looping through an office, both telephone and telegraph, are wired through these jacks. By the operation of two keys and using the plugs at the dispatcher's orders, it is possible to patch up temporarily a line in case of trouble, to interchange circuits, to locate a break or a cross to the nearest station, in fact, to make all the simple tests ordinarily required on a circuit of this character. These two panels have been found an important and useful portion of the dispatching equipment of railroads. Their simplicity makes them especially valuable, as they may be operated by the most inexperienced employes.

Another interesting feature of the Great Northern installation is the use of siding telephones on the Spokane Division. Seventy of these are to be installed. As the use of the telephone for dispatching has increased, the railroads, as in this case, have come to appreciate more and more the advantages of being able to allow the train crews to talk directly to the dispatcher at all important sidings. A siding telephone is sure to be at hand in case of emergency, as a large number of them have been installed. The fact that these siding telephones enable the dispatcher to reach train crews waiting at the sidings and give them orders to proceed permits him to take advantage of all changes in the schedule, prevent congestion and keep traffic moving, thus effecting economies in motive power and reducing overtime expense. Any of these uses warrants the installation of the telphone system, as the savings effected in one emergency will more than pay the cost of the installation.

When this equipment is cut into service the Great Northern will have a telephone train-dispatching system the entire distance from Minneapolis to Seattle, with the exception of two short sections.

A Compact Motor-Driven Meat-Chopping Machine.

A striking example of the simplicity, convenience and efficiency of the electric motor drive is the application shown in the illustration, a ten-horsepower alternating-current motor, gear-connected to a large meat chopper. This machine has a capacity for cutting and recutting 1,500 pounds of beef three times per hour, and 3,000 pounds of pork twice per hour. The compact drive secured by mounting the motor on the chopper frame has the added advantage of lifting the electrical equipment above the floor, always wet and more or less greasy in a sausage room. Besides the protection from dirt and grease thus afforded the motor windings and parts, virtually no space is occupied by the drive.

The improved sanitary conditions, as well as efficiency, secured by avoiding moving belts and shafting, are important results of employing electric drive in the preparation of food stuffs. The self-contained construction of the present application prevents the stirring up of dust or foreign parties in the chopping room. Gear drive has also worked a considerable economy in operation, for while the type of machine illustrated ordinarily requires ten horsepower when belt-driven, it has been found to take only 7.5 electrical horsepower with the spur transmission shown. This economy of power, as well as the low cost of the installation, is perhaps the strongest point in favor of this method of of applying electric power, although the convenience, compactness, simplicity and cleanliness of this drive should not be overlooked.

The machine illustrated is an Enterprise chopper, and was equipped with a Westinghouse type CCL three-phase induction motor for the Ziemsen Butchers' Supply Company, 2855 Archer Avenue, Chicago, Ill.

MOTOR-DRIVEN MEAT CHOPPER.

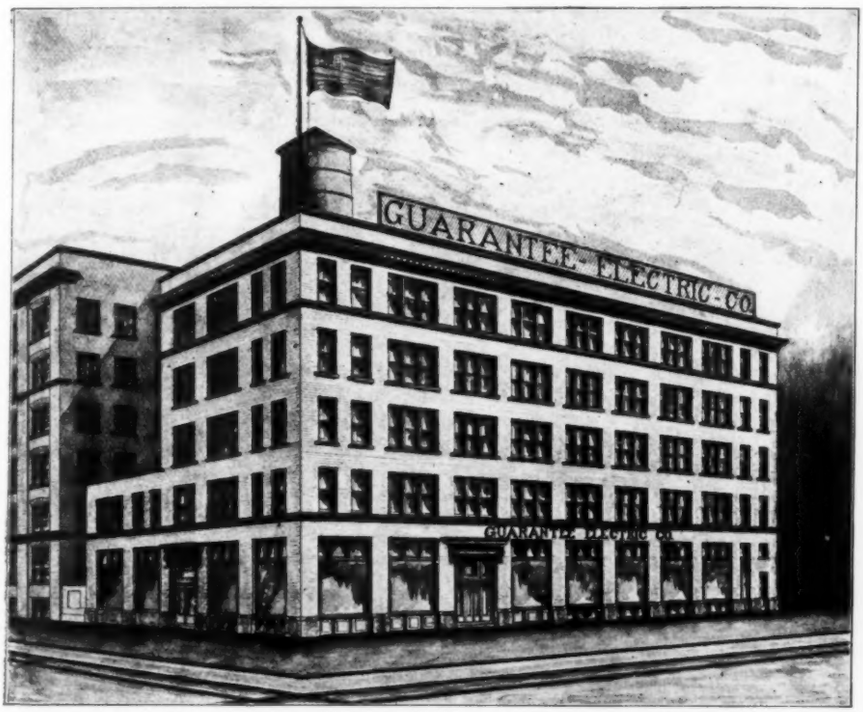
Third Avenue System Taxes.

Judge Lacombe, in the United States Circuit Court, at New York, has authorized Receiver Frederick W. Whitridge to issue certificates to the amount of $1,500,000 to pay the special taxes of the various lines under his charge. The special tax assessments on the roads are as follows: Third Avenue, $1,512,486; Forty-second Street, Manhattanville & St. Nicholas Avenue, $526,398; Dry Dock, East Broadway & Battery Railroad, $245,926; Union Railway Company, $482,746; Kingsbridge Railway Company, $75,584; Southern Boulevard Company, $28,256. The order directs the receiver to pay a million dollars down at once and to settle the residue of the taxes in a just and equitable way.

New Building for the Guarantee Electric Company.

The Guarantee Electric Company, of Chicago, started operation in 1899 in a small way on South Canal Street with about a half dozen machines as its entire stock. In the intervening time it has had to move its quarters several times on account of growth, and now finds it imperative to have its own plant to accommodate its rapidly growing business.

The company has secured the Western Electric property on the corner of Clinton and Van Buren streets and is erecting a six-story modern electrical warehouse. The company has grown until it now has a stock of over 1,000 dynamos and motors, together with a complete line of electrical supplies.



NEW BUILDING OF THE GUARANTEE ELECTRIC COMPANY, CHICAGO, ILL.

The building will have beautiful display rooms which will show its apparatus to good advantages. It will be equipped with electric traveling cranes, and so constructed that the warehouse floor will be of solid concrete resting on the ground, enabling it to carry any weight which might be put upon it, and thus affording it to carry the largest electrical units.

The testing department, which is a highly important feature in this line of business, will be so constructed that either generators or motors of all sizes, voltages and phases can be tested to their full capacity, the alternating current being obtained through a motor-generator set, the motor being arranged for 220 volts, and the generator wound so as to give sixty cycles on one side and 133 cycles on the other, one, two or three phases. All voltages from 5,000 down are available by a series of transformers. This will be controlled by a large switchboard.

The machine shops will be as light and convenient as it is possible to make them, every machine tool being operated by an individual motor, and therefore turning the work out at the most economical cost.

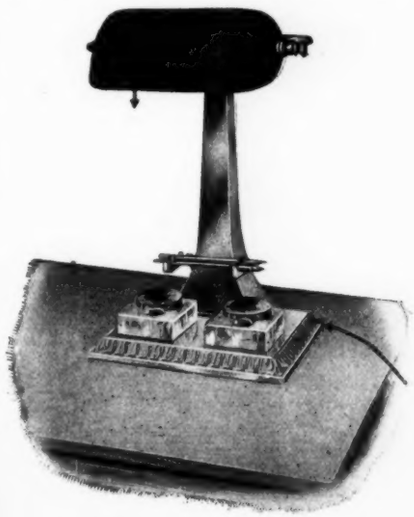
The supply department show rooms will be the most attractive part of the establishment, elaborate plans having been made for displaying the stock to its best advantage. The Guarantee Electric Company respectfully invites its patrons and friends to visit its new quarters.

The electric service of the New York Central Railroad, which now extends from the Grand Central station in New York to Mount Vernon, will be in operation to White Plains by March 1, 1910.

Later in the year active work will begin in extending the electric service on the Hudson River line north of Yonkers.

Emeralite Desk and Piano Fixtures.

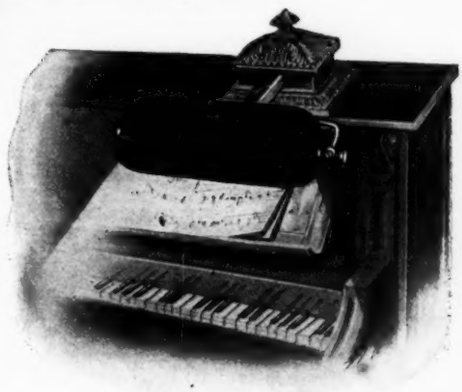
The fact that in an office it is not desirable to have an intense general illumination with a view to having the lights so efficient as to dispense with the use of desk lights altogether for the reason that this intense illumination necessitates a strain upon the eyes when they are raised from the work has led H. G. McFaddin and Company,



EMERALITE DESK FIXTURE.

New York, N. Y., to place on the market a line of fixtures constructed so as to concentrate the light where needed.

These fixtures, two types of which are illustrated herewith, are made for use on desks and pianos and are known as "Emeralite Lights."



EMERALITE PIANO FIXTURE.

Regarding construction, these fixtures have many commendable features. The reflecting surface being opal glass is permanent and does not, therefore, scratch or tarnish. The outside glass is of green which in addition to aiding the reflecting qualities of the reflector,

produces a very restful light for the eyes, avoiding all glare. All parts are of substantial construction and are not easily scratched or bent.

The desk light shown herewith is a decided novelty in portable desk fixtures, combining as it does an inkstand in the base which not only saves space but is very attractive. The height of the stand is always the same, the only adjustment necessary being that of the shade.

The piano light is particularly adapted for use in a parlor as it combines attractiveness with efficiency and reflects the light where it is most needed.

New York Factory of the Cutler-Hammer Manufacturing Company.

Several western manufacturing companies have, of late, found it necessary to establish eastern factories in order to supply the demand for their products.

NEW YORK FACTORY OF THE CUTTLER-HAMMER MANUFACTURING COMPANY.

One of the most recent of these new eastern branch factories is one which was built in New York city by the Cutler-Hammer Manufacturing Company, of Milwaukee, Wis., the largest manufacturing company in the world devoted exclusively to the production of electrical controlling devices.

This new building, which is located in the Bronx, on Southern Boulevard, 144th Street and Timson Place, contains about 100,000 square feet of floor space, is five stories in height and is of brick and steel throughout.

Although electric current for lighting and power is at present furnished to the factory by the New York Edison Company, privision has been made for an isolated electric plant in the basement of the building. All of the motor-driven tools make use of direct current, the alternating current being converted by machinery in the building.

Each floor is supplied with a modern sprinkling system, the fire pump being operated by a 100-horsepower electric motor. This fire equipment, together with the excellent construction and complete electrical installation, make the plant of the Cutler-Hammer Manufacturing Company one of the finest factory buildings in New York city.

An Alternating-Current Portable Drill.

The practice of taking heavy castings to a stationary drill, of spending much valuable time in adjusting them in order that a few brief moments may be spent in drilling, is an instance of wasteful methods that eat into the profits.

The direct-current portable breast drill designed by the General Electric Company has met with great favor and has so satisfactorily demonstrated its ability to do the work for which it was designed that this company is now manufacturing an alternating-current machine which possesses all the superior features of the direct-current drill and which permits the use of this device where alternating current only is available.

It possesses the ruggedness of design required to withstand the hard usage incidental to its service, yet its weight (two pounds) has been reduced to a minimum, that the device may be handled by one person with ease.

An indicating control switch for starting and stopping the motor is located conveniently near the right handle so that it can be operated by the right hand without releasing the hold on the right handle. This feature makes control of the apparatus so simple that the whole attention may be given to the operation of the drill. Hand holes are provided which furnish a means of easy access to the commutator and brushes for inspection and repairs if necessary.

GENERAL ELECTRIC PORTABLE DRILL.

The drill is fitted with a jacob's chuck which will take drills up to and including three-eighths of an inch in diameter.

The machine will drill a hole three-eighths of an inch in diameter and one inch deep in cast iron in twenty-seven seconds, or in machine steel in ninety-five seconds. It will also satisfactorily operate a three-quarter inch wood bit.

The alternating-current portable drill is designed for operation on a 110 or 220-volt, fifty-cycle circuit to which it is connected by screwing the attaching plug into a standard lamp socket.

Smoke Reduction in Cleveland.

A report on smoke reduction has been recently presented by a committee of the Cleveland (Ohio) Chamber of Commerce, of which E. P. Roberts, a well-known engineer, is the chairman. The summary of its report, given by the committee, is as follows:

Estimated direct material loss to Cleveland from smoke nuisance, $6,000,000 annually. Average annual loss per individual, $12; per family, $44.

Committee considers reduction of twenty per cent of smoke nuisance in next two years to be feasible. This reduction would equal reduction of city taxes, exclusive of amount for state purposes, by over twenty per cent, and the entire elimination of the smoke nuisance would be equivalent to practical elimination of city taxes.

Cost of city smoke department, $7,500. If existence of department resulted in elimination of twelve-hundredths of one per cent of nuisance, existence of department is justified.

Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, DECEMBER 31, 1909.—The full details of the proposal to amalgamate the tube railway companies inaugurated in London by the late Mr. Yerkes show that the scheme is one of considerable magnitude. It is proposed to amalgamate the Great Northern, Piccadilly and Brompton Railway Company, the Baker Street and Waterloo Railway Company and the Charing Cross, Euston & Hampstead Railway Company, and to give the new company the name of the London Electric Railways Company. The present combined capital of the three companies is about $36,000,000, but it is proposed to issue additional capital, which will bring this total to $60,000,000. At present, certain shares of the Great Northern, Brompton and Piccadilly railway are guaranteed by the Underground Electric Railways Company of London—which is not an operating company, but owns the Chelsea generating station—but after the amalgamation, this guarantee will cease to exist. The total capital of the new company will be divided into four per cent preference stock as to about one quarter, and the remaining three-quarters in ordinary stock. A minor proposition but yet one of great importance, is to build a new line which will give a physical junction between the Charing Cross Company's lines and those of the Baker Street & Waterloo Company. In this way, not only will the lines be under one control from the management point of view, but they will be able to be worked as one railway in the physical sense. The whole scheme is a far-reaching one in connection with locomotion in London, and is the consummation of the ideas which have prevailed for some years, viz., that the various lines in London should be worked less as isolated ones and more as one harmonious undertaking.

An Admiralty draftsman has been charged with stealing wireless telegraph apparatus and also drawings belonging to H. M. S. Vernon. The charge is a very serious one, as it is made under the Official Secrets Act. The local magistrates at Portsmouth take such a grave view of the matter that they have committed the man to the Assizes, and only allowed him out on bail in sureties of $5,000.

A new electric railway is to be constructed, on the surface, in Surrey, between Wimbledon and Sutton. This is comparatively close to London and no doubt running powers will be arranged over other companies' lines in order that there may be through traffic to the city. The company which is to be formed to construct the line will have a capital of $1,750,000, and a period of five years is asked for within which to complete the line.

Only one corporation is asking for powers in the next session of Parliament to install the trackless trolley system. This is the Leeds Corporation and it is proposed to spend $25,000 upon the purchase of such omnibuses and $45,000 upon the electrical equipment of the roadway.

The competition which even the large electric power supply companies are being subjected to by various forms of internal combustion engines is well shown at Gillingham, near London. Here, the local authorities have had a bad time with their electrical undertaking and they called in an independent expert to advise them. Some extension of plant was necessary and the question was whether it would be cheaper to take a supply from a neighboring power company, or to install a Diesel engine and alternator in the present power station. After considering all things, the expert came to the conclusion that the Diesel engine would give the cheapest result. G.

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, DECEMBER 30.—The Swedish government is taking measures to secure the power which is needed for operating the Ofoten railroad line running from the Kiruna region to the Norwegian frontier. We already had occasion to speak of this project, which is quite an extensive one, and involves the changing over of the entire railroad line to the electric system. Hydraulic power will be used to secure the current for this purpose, and at present the government is engaged in drawing up the plans for the hydraulic work. These are two different falls which are available for this enterprise, one of these being located on the Torne stream, and it is calculated to furnish at least 16,000 horsepower. On the Lule River there can also be erected a turbine plant at the Porjus Fall, which will be a much larger one, as it is expected to give about 50,000 horsepower.

Among the recent Italian projects, I note that the hydraulic plant of Fatelica is to furnish a supply of current for the recent electric-lighting project for the town of Cerrato.

In France there are various electric traction enterprises under way, among which may be mentioned the plans for an electric tramway line in the city of Caen. The municipal council is considthe plans for several sections of line at present. An electric road will soon be constructed from La Comaille to Alligny, and the municipality of Autun is engaged on the plans for an electric line running between that locality and St. Leger. In the Mediterranean region I note the project for a suburban line from Toulon to Monteau. An electric road is also to be built from Louhans to Beaufort.

An extensive project is being considered by the municipality of Kharkoff, and it will rank among the largest in Russia as concerns electric tramways. There will be erected a power plant of some size in or near the city for operating the lines, and the amount to be expended for the entire enterprise is near $1,000,000.

In the suburban region of Paris there is to be built an electric tramway line of some length, which is expected to carry a heavy traffic. The line will start at Suresnes and will pass by St. Cloud, terminating at Garches. A company for operating the line is now being formed at Paris. A. DE. C.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, ONT.—The Grand Trunk Railway Company intends installing a telephone system on its North Bay line, and work will be begun at once. It will be used, at first, for local railway message work, and later for train dispatching.

The electrical engineer for the city of Toronto, Ont., says that the recent entrance of a number of small municipalities into the hydroelectric power chain will take about twenty-five per cent of the capital charges for the transmission line off Toronto's shoulders. This will enable the city to sell power at very attractive prices and hasten the day when the city will use 25,000 horsepower, entitling it to a reduction of rate to $9 per horsepower, to be paid at Niagara for the power. Voting in the recent municipal elections in Ontario, upon electric by-laws, showed that the government's hydroelectric power policy carried in several of the smaller towns.

Information respecting the steam and electric railways of Canada, is contained in the railway statistical report to parliament which has just been given out by the department of railways here. The total mileage of electrical railways is given as 988 miles of main track. The paid up capital of these lines was $91,604,989, and the gross earnings $14,824,936, an increase of $817,887 over the previous year. The net income of the various roads aggregated $4,716,308, or five per cent on the capitalization. The electric railways carried 314,026,671 fare passengers and 81,670,945 transfer passengers on their 3,544 cars. The total mileage was 60,152,846, of which 737,820 was in the carrying of mails, freight and express traffic. There were, in 1909, 10,557 employes of electric railways and their wages amounted to $6,761,281.

Dr. G. D. Condie, of Montreal, one of the promoters of the St. Lawrence and Ungava Railway project, states that the northern country around Hudson Bay is extremely rich in minerals and waterpowers. It is estimated that there are waterpowers aggregating 10,000,000 of horsepower along the projected route; and when the road is built, electricity will be the chief motive power used. It is expected that the work of construction will begin next spring. A large amount of French, Belgian and American capital is behind the enterprise which is capitalized at twenty-five millions of dollars. The length of the road will be about 1,000 miles.

The project of damming the St. Lawrence at the Long Sault Rapids is a work of such magnitude, and might involve so many consequences to navigation and other interests, that a long and earnest consideration of the problems involved has been given by the International Waterways Commission. The scheme, in its potentialities, is the largest hydraulic proposition of this kind in the world. It was estimated that the full development of the power would produce the enormous total of 700,000 horsepower. It will be within seventy miles of Montreal. In addition to the engineering problems, questions of international policy had to be considered. Peculiarly enough, at the point where the dam is to be constructed, ninety-five per cent of the water of the river is on the American side, and but five per cent on the Canadian side. Under the terms of the treaty of Ghent, however, where a waterway constitutes the boundary, the water is held in common by both nations, and is not divisible. Consequently, the Canadian rights in the Long Sault waterpower are equal to the American, and the work is to be proceeded with on the understanding that Canada is entitled to share equally with the United States in any power that may be developed. W.

IMPORTANT DEVELOPMENTS.

(Special Correspondence.)

POWER FROM THE DES MOINES.—According to present plans three dams instead of one are to be built across the Des Moines river at Fort Dodge, all within three miles of each other. The company which is promoting this development already owns a dam and power plant on the Michigan river and it is believed the present plant will be even more successful than the one on the Michigan river.

TO DEVELOP ALASKA WATERPOWER.—Construction of an immense power plant, opening up of jade and copper mines on the Kobuk river, and development of bituminous coal beds at Cape Lisburne, are plans which will be carried into effect next summer in Alaska by a syndicate of English capitalists, headed by Colonel L. Stuart-Weatherley and Lord Fox Ramsay, a member of the Scottish peerage. T. A. Davis, manager of the John J. Sesnon Company, is authority for the statement that the Englishmen have bought out the Sesnon Company's electrical plant at Nome, and that arrangements have been made for enlarging it at an initial cost of $442,000. The British syndicate has $4,000,000, a portion of which was expended last summer.

CAROLINA-TENNESSEE COMPANY TO BUILD A $5,000,000 PLANT.—Advices from the South state that the Carolina-Tennessee Power Company will be ready to start on a $5,000,000 power plant early in the spring, the main object of which is to furnish power for the two big copper companies at Ducktown, Tenn. Two dams will be built on the Hiwassee River—one at Appalachia, and the second twenty miles above Appalachia. They will generate 60,000 horsepower. All property rights for the overflow lakes have been secured. Five hundred men will be put to work just as soon as the weather will permit. New York and Boston capitalists are behind the enterprise. It is said that towns as far south as Rome, Ga., and Etowah, Tenn:, are to be supplied with electric current.

NEW PLANS FOR AU SABLE POWER.—The plans of the newly formed Commonwealth Power, Railway and Light Company call for the development of the Au Sable River and the furnishing of light and power from that source to a district of almost 10,000 square miles. It is estimated that it will be possible to furnish electricity in sufficient quantities and at a price low enough to place it on all the farms within a radius of 200 miles for lighting and power purposes, as well as supplying the cities in these districts. The development plans include the improvement of the river by thirteen or fourteen dams, covering the river for a distance of ninety miles from its mouth. The engineers estimate that 66,000 horsepower can be secured. The dams on which work has already started, call for the development of 10,000 horsepower, with which the work will be started. The total cost of the dams will be some $7,000,000 or upwards.

LIGHTNING AND POWER.

(Special Correspondence.)

DULUTH, MINN.—A vote will be taken in February on issuing light and water bonds for $200,000. C.

BURWELL, NEB.—F. M. Currie, of Broken Bow, Neb., is working on a proposition to put in a water-power electric plant. C.

RANSON, PA.—The Lehigh Valley Coal Company is installing a private electric light plant. James Ralston is in charge of the work.

TUCSON, ARIZ.—The Helvetia Copper Company will install a modern power plant near this city at a cost of several thousand dollars. A.

VAN HORN, TEX.—J. E. Cox, owner of the Van Horn waterworks, will put in an electric light plant soon to supply the whole town with light. A.

WASHINGTON, ILL.—R. M. Howard, former manager of the Green Bay, Wis., traction system and electric light plant, has purchased the electric works in this city.

WILMINGTON, DEL.—The Peninsular Electric Company, with a capital of $50,000 has been incorporated by E. O. Walton, Iron Hill, Md.; L. Gibb, J. W. Hussey, Philadelphia.

WILMINGTON, DEL.—The Wonder Electric and Power Company has been incorporated with a capital of $500,000 by C. A. Higbee, J. S. Austin, Philadelphia, Pa.; J. H. Whiteman, Wilmington, Del.

MORETOWN, VT.—At a special meeting the voters agreed to extend the time of completion of the Mad River valley power plant one year. This plant will furnish about 900 horsepower to the section.

INDIANAPOLIS, IND.—The Indiana Power Company has incorporated with a capital stock of $25,000. The object of the company is to equip an electric power plant to supply power to industrial concerns. S.

LA PORTE, IND.—The La Porte Electric Company has given notice of an increase of capital stock from $150,000 to $300,000. The company proposes to extend the plant and install some new equipment. S

AGUASCALIENTES, MEX.—The Chapala Hydroelectric and Irrigation Company will furnish this city with power and light. The company will build its transmission line into this city within the next two years. A.

TAOS, N. M.—The Rio Lucero Power Company has been incorporated in Taos County with a capital of $100,000. The incorporators and directors are Malaquias Martinez, Bert G. Phillips and Parker N. Black.

CHIHUAHUA, MEX.—The Mayo River Power and Land Company, with a capital of $5,000,000, has taken over power concessions on the Mayo River and will build a series of dams for the development of power. A.

SPOKANE, WASH.—The Brown Electric Company has been incorporated at Chelan with a capital stock of $500,000 by G. H. Doerr, A. S. King, W. G. Paine, W. G. Davidson, Fred Phair, L. W. Hutton and G. H. Martin.

JACKSON, MISS.—A sale has just been made whereby the local light and railway systems will be transferred from the Memphis capitalists formerly in control to Jackson parties. The price of the holdings was $300,000 cash.

LOCUST, PA.—A large power plant is now in the course of construction for furnishing light and power to the Locust Gap collieries. When the installation is finished this will be one of the best equipped collieries in the section.

PIPESTONE, MINN.—The Pipestone Electric Light Plant has undergone a change of ownership, and Coler Campbell, of Huron, S. D., is now at the head of the concern. The plant has formerly been controlled by Minneapolis capitalists.

HARTFORD, CONN.—The New Milford Electric Light Company has filed a certificate of its action in increasing its capital stock from $35,000 to $100,000. The new owners of the concern are carrying out plans for improvements and expansion.

SPRINGFIELD, S. D.—The contracts have been let for the installation of an electric lighting plant in the State Normal School. Mr. Wheeler, of Sioux Falls, received the contract for machinery, and H. S. Tammen, of Yankton, will do the wiring. C.

McKEESPORT, PA.—The local electric light plant is for sale, and negotiations have been pending with the West Penn Railways and their affiliated companies. The town council has given a figure which has not, however, been made public.

ANDERSON, IND.—The Central Station Engineering Company, of Chicago, has prepared plans for rebuilding and enlarging the plant of the Home Heating and Lighting Company, of this city. The estimated cost of the addition and equipment is $150,000. S.

TIFFIN, OHIO.—The Tiffin Electric Company has been incorporated with a capital of $500,000, to supply light and power. John M. Ormond, Louis H. Payne, F. Schreiner, R. W. Burton and E. H. Cady are the incorporators.

COLUMBUS, IND.—The Central Indiana Lighting Company has completed its new powerhouse at this place. This is the most costly power and lighting plant in this part of the state. In addition to lighting the city the company supplies power to the traction company. S.

CHAMBERSBURG, PA.—The borough council has voted bonds to the amount of $19,227 to equip the electric light plant. The Westinghouse Company, the Allis-Chalmers Company and the Fort Wayne Electric Company bid on supplying the necessary equipment.

CLARKSVILLE, TENN.—The Clarksville Electric Light and Railway Company has recently been sold to a company represented by E. L. Fisher of Danville, Ill. It is expected that the company will take over the plant soon and begin the work of improvement and extension.

BEDFORD CITY, VA.—The city has voted on an issue of bonds of $100,000 to establish a hydroelectric plant and carried it by a good majority. Several brokerage firms have been negotiating for the purchase of the entire issue, and the council will probably close a deal in the near future.

FREDONIA, N. Y.—A plan is being made for securing electric power from the east branch of the Canadaway Creek and everything is now in proper trim to organize the company to carry out the plans for getting 1,800 horsepower electricity from the source of supply in the Arkwright Hills.

KALISPELL, MONT.—The Northern Idaho & Montana Power Company has taken control of all light, power and telephone business in the Flathead valley and northwestern Montana and Idaho through the acquirement of the Big Bend Light and Power Company operating the plant at Whitefish.

CASTINE, ME.—The Castine Light, Power and Heating Company has been incorporated for generating and supplying gas or electricity in Castine, Brooksville and Penobscot. The officers are: President, William A. Walker; treasurer, William G. Sargent, both of Castine, and the capital stock is $10,000.

FT. WAYNE, IND.—The directors of the General Electric Company has appropriated $1,000,000 for the construction and equipment of an addition to its plant in this city. James J. Wood, general superintendent of the local plant, says the extension when completed will provide employment for 500 additional men. S.

EASTON, PA.—The Easton Electric Light Company is placing new wires and transformers preparatory to changing its sys-

tem from a 1100 single phase to a 2200 three-phase lighting system. The new machinery for the purpose will arrive after the holidays and will be in operation the latter part of January.

PENDLETON, ORE.—The water power sites on the north fork of the John Day River, together with franchises and other rights, have recently been sold to the Umatilla Railway and Electric Power Company. The promoters are being assisted by prominent men in Portland, and construction work is to be started in a short time.

PORTLAND, ORE.—A new powerhouse is to be erected for the Portland Railway Light and Power Company by the Pacific Engineering Company of this city. The site chosen is at the foot of East Lincoln Street, near the company's yards. Piling will be driven for the foundation, and upon these will rest a concrete foundation.

OSWEGO, N. Y.—The contract for city lighting has been awarded to the Peoples Gas and Electric Company for a price of about $26,000 per year. The arc lights are supplied at the rate of $66 per year and thirty-two-candlepower lamps at the rate of $18 per year. The sixteen candlepower lamps are furnished for $3.65 per lamp per year.

RIDGEVILLE, S. C.—There is a report current that a $10,000,000 fertilizer plant is to be built on the Edisto River, near here, with hydroelectric power to propel the proposed plant. D. G. Zeigler, of Florida, is said to be interested in the proposition, and a Chicago syndicate has made an offer towards the construction of such a plant. L.

HOUSTON, TEX.—The Houston Lighting and Power Company is placing its wires under ground in the business center of Houston. A new system of lighting the city has been adopted. The swinging arc lights will be replaced by iron posts on the sidewalks, four of these lights to be at the intersection of each street and two in the middle of each block. D.

CHARLOTTE, N. C.—The total investments in new waterpower developments for the year 1909 in North Carolina included the following: Hendersonville, $150,000; Carolina-Tennessee, $5,000,000; New Bern, $500,000; Nor Carolina Traction Company, $2,000,000; Green River, $100,000 Appalachian, $100,000; Southern Traction and Power Company, $3,500,000; Randolph, $100,000. L.

SIOUX FALLS, S. D.—All of the $20,000 of the capital stock of a company recently organized at Gregory for the purpose of establishing and operating an electric light system at that place has been sold, and it now is assured that the plant will be installed. The plant will be of sufficient capacity to also furnish power for factories and other institutions needing power.

TRINIDAD, COLO.—The Northern Securities Company, for $500,000 recently bought at a sheriff's sale the Southern Colorado Power & Railroad Company, which some time ago went into the hands of a receiver. It is said that the Northern Securities Company is a temporary holding company for the Colorado Railway, Light & Power Company, incorporated for $5,000,000 last Tuesday.

GREERS, S. C.—The town has let the contract for street and public building lighting to A. H. Miller, who will install the lighting system, the street lights to cost $67.50 per annum. The current will be supplied by the Southern Power Company, of Charlotte, a contract to this effect having recently been prepared. Additional lights may be installed at the same price named above. L.

TOLEDO, O.—It is expected that a final solution of the city lighting problem at Defiance, O., will be worked out in the near future. Three concerns have finally entered the competition, the Defiance Gas and Electric Company, the Warner Arc Lamp Company and the Valley Power Company, a projected water power enterprise. A movement for a municipal plant is also on foot as a last resort. H.

LOUISVILLE, KY.—A power house to cost $300,000 is to be erected by the Kentucky Electric Company in this city. The building will contain two 1,500-kilowatt turbines and will permit of an increase of the capacity of the company's plants from their present 2250 kilowatts to 5,250 kilowatts. Water will be brought from the river by a tunnel which is now in the course of construction.

PHOENIX CITY, ALA.—The question of building a municipal electric-lighting plant was considered at a recent meeting of the Town Council, and a committee was appointed to investigate the problems of cost, necessary material, conveniences, etc. The money for the enterprise is said to be on hand, and there seems to be little doubt but what the plan will assume definite shape within a short period. L.

WAYCROSS, GA.—The Ware County Light and Power Company has been incorporated with capital stock of $250,000 by Burdette Loomis and Burdette Loomis, Jr., of Hartford, Conn., P. R. Bomeisler, of East Orange, N. J., and Leon A. Wilson, W. W. Lambdin and John A. Bennett, of Waycross. This company will succeed the existing light and power company at Waycross, taking over the property and making improvements. B.

WASHBURN, WIS.—The new transmission line which will convey power for electric lights and motors in this city is nearly completed and the sub-station is almost ready to be connected up. The power will be furnished by the Ashland Light and Power Company from its dam at White River on contract with the Washburn Lighting Company. The current will be continuous and will be available for electric machines and lights.

TRINIDAD, COLO.—The sale of the property of the old Southern Colorado Power and Light Company, which was made a short time ago, has recently been confirmed in the court of Judge Henry Hunter. The new Colorado Railway, Light and Power Company has just been incorporated with a capital of $5,000,000. Machinery amounting to $250,000 has been purchased, and work will be commenced at once in improving and enlarging the plant.

RICHMOND, IND.—The receipts of the municipal light plants for the year 1909 were $45,361.82 in excess of operating expenses, and is said to be the banner year for the plant. The gain in business was $12,510.48, and the total disbursements were $53,461.16. The city expended $10,493.72 for new equipment and extensions. The plan is now to purchase the water plant of the private owners and operate it in connection with the electric light plant. S.

VAN BUREN, ARK.—Citizens of Sebastian and Crawford counties have organized the Fort Smith, Van Buren and Interurban Light and Traction Company, with a capital stock of $10,000, for the purpose of building a traction line through Crawford, Franklin, Johnson, Madison, Newton, Boone and Searcy counties. The officers of the company are: W. F. Keller, president; L. W. Burgett, vice-president; T. A. Bayley, secretary; S. A. Pernot, treasurer, and S. R. Chew, attorney.

SHOALS, IND.—The Shoals Power Company has filed articles of incorporation with the secretary of state. The capital stock is $50,000. The object of the corporation is to erect and equip a plant to carry on the business of manufacturing and the creation, transmission and distribution of electricity to towns and cities and to the public in general for heating, lighting and power purposes. Henry A. Mansfield, Samuel A. Feschen, Fred M. Bachman and Frank T. Edenharter are directors. S.

WEST NEWTON, PA.—After several months of investigation which showed the municipal light plant to be a losing venture, the City Council has voted that it shall be sold. The present building, together with all machinery lines, equipment and franchises, go to the purchasing company for $14,000 cash. Under the new ownership local consumers will be supplied with a good quality of light at all hours, day and night, and at a stipulated rate of not more than ten cents per kilowatt hour.

JOHNSBURG, N. Y.—The North Creek Electric Company has asked permission of the public service commission to exercise its franchise here, and to construct and maintain an electrical power plant. It is proposed by the company to construct a hydroelectric plant and to secure water power from Long and Clear ponds. The company asks permission to issue bonds to the amount of $20,000 and common stock for the same amount.

NEW HAVEN, CONN.—The Edison Electric Illuminating Company, of which the late Fred A. Gilbert of the city was the former president, has announced its intention to make an increase of 19,452 shares, increasing the capital of the company to $15,561,300. The new stock will be issued to stockholders at the rate of one share for seven at $215 the share. The stock, which pays ten per cent with extra dividends, is selling at about $253. It is claimed in Boston that the rights on the stock are worth $5.

GLENWOOD, NEV.—The Glenwood Light and Water Company of Glenwood Springs has been absorbed by the Glenwood Light and Power Company, recently incorporated in Nevada, and will take over the present plant near Glenwood Springs. In addition to this the new company will tap Grizzly and Noname creeks and derive water for power and irrigation purposes. The company purposes to supply most of the cities and towns of Colorado and Nevada with power for lighting and manufacturing purposes.

OAKLAND, CAL.—The People's Electric Light and Power Company of Oakland has filed its articles of incorporation. This company is an adjunct of the Great Western Power Company, whose president is Edwin Hawley of New York, and was organized for the purpose of local distribution of light and power. The capital stock of the new company is $500,000. The new directors are D. U. Toffelmeier of San Leandro and J. H. Hornung, A. C. Sprout, F. H. Woodward and W. H. Spalding, all of Oakland.

COHOES, N. Y.—The Fuld & Hatch Knitting Company has just placed an order with the Allis-Chalmers Company for a 600-kilowatt, 3600 revolutions per minute, 480-volt, sixty-cycle, three-phase condensing steam turbo-generator. A Tomlinson barometric condenser will maintain the vacuum. Excitation will be by means of a fifteen-kilowatt motor-generator set. This company now has two 300-kilowatt turbo-generators in service, but the growth of its business necessitates more power for the operation of its mills.

BUTLER, PA.—The Evans City Light, Heat and Power Company has recently been chartered to do a general lighting and heating business. The stockholders of the new company are R. A. Todd, A. C. Frey and S. A. Roeliff. The company expects to commence in a short time work on the construction of the lines for that place, the power plant of the company being located at Ellwood City, and it is the intention of the company to furnish light and power to all of the towns between Ellwood City and Evans City.

PORTLAND, ORE.—The Portland Railway, Light and Power Company is again increasing the capacity of its hydroelectric plant.

It has recently placed an order with the Allis-Chalmers Company for a 3,750-kilowatt, waterwheel-type, 11-000-volt, sixty-cycle, three-phase alternator. This will be of the same general design and manufacture as the two 2,500-kilowatt, 11,000-volt, thirty-three-cycle alternators already installed and will be semi-enclosed. A fifty-kilowatt, 120-volt exciter will be direct connected to an extension of the alternator shaft.

SHELBYVILLE, IND.—There is a movement on foot to consolidate the Citizens' Light and Water plant and the Shelbyville artificial gas plant now owned by separate companies. The plan is to sell the properties to a company represented by Petry & Company, bankers of Chicago. If the deal is closed, and there is evidence that it will be, a new combined station will be erected and installed with the most approved and up-to-date equipment. The increasing number of factories in Shelbyville creates a greater demand for light, power, gas and water. S.

GUANAJUATO, MEXICO.—The Guanajuato Power and Electric Company which recently increased its capital stock from $3,500,000 to $5,000,000 gold, is preparing to enlarge greatly its operations in this part of Mexico. It has secured options to purchase the electric light and power plants in the cities of Leon, Irapuato, Silao, Valle de Santiago and other places. It will increase its hydroelectric capacity and extend its transmission lines. The company is now furnishing power for cities, towns, mines and various other kinds of industries in a territory embracing about 11,250 square miles. D.

EAST BOSTON, MASS.—The Maverick Mills are being re-arranged so that the machinery will be driven by electric motors. Several machines will be driven by a single motor. The contract for the necessary electrical machinery has been given to the Allis-Chalmers Company. This will include a 1500-kilowatt, sixty-cycle, three-phase, 600-volt condensing steam turbo-generator. A fifteen-kilowatt motor-generator set and an engine-driven set of the same size are provided for excitation. A four-panel switchboard will carry the necessary instruments and switches. Four 100-horsepower and seven 150-horsepower induction motors will drive the looms.

VALDOSTA, GA.—The city council has granted a twenty-year lighting, heating and power franchise to the Valdosta Ice and Manufacturing Company, a new company being organized by G. W. Varn and associates. A five-year contract for arc lights at $62.50 per lamp per annum was made by the city with the Valdosta Ice and Manufacturing Company. The Consolidated Ice and Fuel Company is petitioning the court for permission to change its name to Consolidated Ice and Power Company, and it is stated that the latter company will expend $100,000 in establishing electric and power plant. To these two companies named above the city of Valdosta granted franchises as stated for a price of $6,000 each, to be paid for $300 annually. B.

MILTON, PA.—Some time ago the Milton Electric Light and Power Company and the Lewistown Milton and Watsontown Passenger Railway Company were sold to a syndicate of Harrisburg capitalists, the principals being John F. Whittaker and D. L. Deihl. Subsequently it was announced that the light and power plant had been sold to Philadelphia capitalists, the original purchasers retaining the trolley line. Both of these have now been turned over to the new owners. The light and power plant will be operated by a new corporation, the United Light and Power Company, which will erect a new power plant on South Front Street. It will be equipped with the most up-to-date machinery and will have a capacity sufficient to light a town twice Milton's present size.

GRAND RAPIDS, MICH.—Details in regard to the proposed $18,000,000 merger of street railway, power, gas and electric lighting concerns in Michigan have recently been given out. The corporate name for the combination will be the Commonwealth Power, Railway and Light Company. Of the total capital stock $6,000,000 will be preferred and the balance common. No bonds are issued. The following companies are to be included in the merger: Commonwealth Power Company, of Grand Rapids; Muskegon Power Company, Saginaw-Bay City Railway and Light Company, Grand Rapids Railway Company, Michigan Light Company, Flint Electric Company, Flint Gas Company, Cadillac Water and Light Company, Charlottte Electric Company, Pontiac Gas Company, Siawassee Light and Power Company and Ausable River property and rights. The total combined earnings of the companies for the calendar year 1909, November and December estimated, were $6,192,000, providing more than double the amount required for dividends on the preferred stock. The new concern is being formed by a syndicate of New York, Philadelphia and Michigan bankers, including Hodenpyl, Walbridge & Company, of New York; F. W Clark & Company, of Philadelphia, and W. A. Foote, of Jackson. Mich.

ELECTRIC RAILWAYS.

(Special Correspondence.)

SAN FRANCISCO, CAL.—The general offices of the United Railroads of San Francisco will be removed from the Balboa building to the Wells Fargo & Company building. A.

GASTONIA, N. C.—Work has been started on the local electric railway, a charter having been granted the Southern Power Company for this purpose some time ago, on condition that work be started by January 1, 1910. L.

BRAWLEY, CAL.—W. F. Holt has completed arrangements to build the Holton interruban railway westward from El Centro to New River, where a new town is to be started. A.

GREENFIELD, IND.—The City Council has granted a franchise to Perry Freeman, of Richmond, for a street car line in this city to be known as the Greenfield & Pendleton Line. The line is to be completed within two years.

DAVENPORT, IA.—The capital stock of the Davenport-Manchester Interurban Railway Company has recently been increased from $15,000 to $650,000, and it is probable that construction work will be commenced this summer.

MARSHFIELD, ORE.—The Union Traction and Terminal Company has been incorporated here with a capital stock of $1,000,000 for the purpose of building electric lines in Marshfield and North Bend and between the two places. A.

LYNCHBURG, VA.—The Lynchburg & Roanoke Electric Railway plant and the local gas plant have passed from control of a Philadelphia syndicate, which has owned them for eight or ten years, into the hands of the American Railways Company.

YONKERS, N. Y.—The announcement has been made by the New York Central Railroad Company that electric engines are soon to be put in operation between North White Plains and the city. New substations are being built at White Plains and Tuckahoe.

GREENFIELD, IND.—The Commissioners of Hancock County have granted a franchise to Perry J. Freeman and associates, of Richmond, to construct an interurban road across highways and through the county from Greenfield to Pendleton—a distance of sixteen miles. S.

MARYSVILLE, CAL.—The California Midland, a railroad projected between Marysville, Grass Valley and Nevada City, will be ready for operation by March 1, 1910, according to announcements made here and at Hammonton. The road is backed by John Martin and others. The grading has already been completed. A.

HAVRE DE GRACE, IND.—Plans are under way for the construction of an electric railroad to Baltimore via Belair. The project is being promoted by Baltimore County, Harford County and Baltimore capitalists, under the leadership of Mr. Alexis Shriver, of Belair. The improvement will probably cost in the neighborhood of $1,500,000.

LOS ANGELES, CAL.—At a meeting of the Boyle Evergreen Improvement Association the committee in charge of the movement to secure the extension of the Brooklyn Avenue car line from Evergreen Avenue east to the city limits, reported that of the $30,000 which it expected to collect from property-owners, only $14,000 had been received. A.

SAN ANTONIO, TEX.—The survey for an interurban line from San Antonio to Fort Worth has been completed here and C. L. Hodges, of Chicago, chief promoter, declares that the laying of tracks will begin within two months. The proposed route is through New Braunfels, San Marcos, Austin and Hillsboro.

TOPEKA, KAN.—A charter for an electric railroad, with termini at Wichita and Belleville, has been issued. The road will operate through Newton, Canton, Salina, Minneapolis and Concordia. The capital is $1,000,000. All of the incorporators are Kansas men. Active construction work is to begin in the early spring on the Kansas City, Olathe, Lawrence & Topeka electric railroad.

PEORIA, ILL.—The Chicago Bloomington and Peoria Electric Railway Co. has been incorporated with a capital of stock of $25,000. The line will traverse the counties of Cook, Du Page, Will. Kendall, Grundy, La Salle, Livingston, Woodford, Tazewell, McLean and Peoria. The incorporators are Jerome J. Danforth, Charles S. Sallers, Verne A. Hyde and Frank M. Capp, all of Chicago, with Virginia Garnett of Highland Park. V.

WRAY, COL.—At a meeting of a number of Wray capitalists the matter of forming a corporation for the purpose of building an electric line from this place across the country south to Burlington, was seriously considered, and it is probable that the undertaking will be started early in the summer. The distance is seventy miles, and aside from reaching three inland towns, would traverse one of the richest agricultural and cattle regions of the Middle West.

VALLEY FORGE, PA.—A charter has been granted to the Phoenixville, Valley Forge and Strafford Street Railway Company, which is to build a line ten miles long, connecting Phoenixville with Strafford by way of Valley Forge. The capital is $60,000 and the incorporators are: Thomas E. O'Connell, West Chester, president; Senator O. E. Thompson, John A. Dismant, C. F. Bowden, Samuel W. Deninger, A. W. Kley, H. H. Gilkyson, Jr., E C. Meir and I. E. Miller, Phoenixville.

HOUSTON, TEX.—The Galveston-Houston Electric Company has mortgaged its holdings in Texas to the City Trust Company of Boston, Mass., for $5,000,000, the instrument being filed a few days ago in the county clerk's office at Houston. This secures the $5,000,000 of bonds which are to be issued for the construction of the company's interurban railway between Houston and Galveston, fifty-one miles. The bonds are five per cent and mature in forty-five years. This company belongs to the Stone-Webster syndicate of Boston. D.

SAN JOSE, CAL.—The "San Jose Railroads" has recently been incorporated to consolidate the railroads of San Jose. Should the consolidation be effected it will be the most important railway movement that has been made in this section. The capital stock of the new company is $5,000,000, and its incorporators are Lewis E. Hanchett, W. R. Lawson, S. S. Baldwin and E. M. Rea, respectively president, manager, secretary and attorney for the San Jose and Santa Clara County Railroad Company, and F. E. Fitzpatrick, who is associated with John Martin, a San Francisco capitalist.

SAN BENITO, TEX.—A system of electric interurban lines is to be built out of San Benito. The project is being promoted by S. A. Robertson, representing a syndicate of St. Louis, Mo., and Pine Bluff, Ark., men. The lines will carry freight and passengers and will connect several of the towns in the lower Rio Grande Valley with San Benito. The preliminary survey for the main line from San Benito to the river, about ten miles, has been made. More than thirty miles of track will be embraced in the entire system. Bonuses to the amount of about $100,000 have been raised in aid of the project. D.

SAN FRANCISCO, CAL.—By a vote of practically three to one the votors of San Francisco on December 30 voted in favor of issuing bonds to the amonut $1,900,000 for the construction of a municipal electric railway on Geary Street and an additional $120,000 for the construction of a short line down Market Street from the junction of Sutter to the ferry. Both the outgoing and the incoming city administrations are committed to the construction of the roads in question and it is believed that the bonds will be issued and work on the road started as soon as possible, though it is expected that the issuing and selling of the bonds as well as the construction of the road will be fought in the courts at all possible points. A.

PERSONAL MENTION.

W. H. ZIMMERMAN, formerly manager for the Michigan Power Company, has been retained by the state railroad commission as consulting engineer.

R. E. SCHAULIN has left the Chicago office of the Westinghouse Electric and Manufacturing Company to take a position with the Westinghouse Lamp Company, with headquarters at the general offices at Bloomfield, N. J.

E. W. WINTER, president of the Brooklyn Rapid Transit Company, has booked passage for a trip to the Mediterranean and will sail from New York February 2 for a much needed rest. Mr. Winter will spend some weeks in Egypt or Naples.

GORDON CAMPBELL, former vice-president and general manager of the York Railway Company, at York, Pa., has been elected president of the same system. Louis C. Mayor, formerly chief engineer, was promoted to the office of vice-president.

DANIEL D. BENTZINGER, of Burlington, Iowa, has recently been appointed superintendent of electric light, steam heating and electric power, of the Peoples' Gas and Electric Light Company. Mr. Bentzinger has been in the service of the company.

W. F. BAY STEWART has resigned as president of the York Railways Company, York, Pa., to give his undivided attention to a number of large enterprises in which he is interested. Gordon Campbell, formerly of Washington, vice-president and general manager, was elected to fill the vacancy.

HJALMAR HERTZ, assistant chief engineer of the Western Electric Company, has resigned to accept a position as advisory engineer with the General Electric Company, with headquarters at Lynn, Mass. Mr. Hertz has been connected with the Western Electric for some time, and has achieved remarkable success as a designing engineer.

F. V. L. SMITH has recently resigned his position as manager of the Atlanta and New Orleans office of the Sprague Electric Company. Mr. Smith has established an office at 702 Empire Building, Atlanta, and will act as sales agent for a number of electrical manufacturing companies. His territory as agent covers practically all the southern states.

J. W. MELCHERS, superintendent of the Union Telephone Company of Alma, Mich., has been elected vice-president of the Michigan Independent Telephone and Traffic Association, which is the same company that has been acting as a clearing house for the Michigan Independent line as a co-operative company and was only recently incorporated.

HARRY A. HAGEMAN has resigned as assistant superintendent of mechanical operations at the plants of the Niagara Falls Power Company and the Canadian Niagara Power Company, Niagara Falls, and will leave that city for Seattle, Wash., to accept a position with the Stone-Webster Engineering Corporation to design and construct a power development plant of considerable magnitude.

CHARLES M. HALL, vice-president of the Aluminum Company of America, left Niagara Falls, accompanied by Dr. W. H. Hodge, for the Pacific Coast, the trip being for Mr. Hall's health. It will be recalled that while abroad last year Mr. Hall was taken sick. At that time Dr. Hodge went to Europe and brought him home, after which Mr. Hall was operated upon in Rochester, Minn. While he has been growing stronger, the belief prevails that a winter in California will greatly improve his condition.

C. C. PEIRCE, of the General Electric Company, was a leading member of the reception committee on the occasion of the recent meeting of the New England Railroad Club, at the Hotel Somerset, Boston, January 12. A number of Mr. Peirce's New York friends came over as his guests on this occasion and greatly enjoyed the event, which was addressed by the Hon. E. S. Draper, governor of Massachusetts; William C. Brown, president of the New York Central & Hudson River Railroad Company, and George A. Post, president of the Railway Business Association. The attendance numbered over 500, and the occasion was very enjoyable and instructive.

WALTER ELLIS, general superintendent of the Philadelphia Rapid Transit Company since 1895, has been relieved of that office at his own request. He will be succeeded by M. F. Ryan, now assistant general superintendent. S. G. Moore, superintendent of the Willow Grove division, has been named to succeed Mr. Ryan as assistant general superintendent. Mr. Ellis will continue to be attached to the president's office. He has served the company or its predecessors for thirty years. He began as a conductor and was then promoted to receiver, street superintendent, dispatcher, superintendent of the Twenty-seventh and Girard avenue depot, and fifteen years ago was made general superintendent. Mr. Ryan, the new general superintendent, has been in the street railway service in Philadelphia since 1872. In 1908 he was appointed assistant to Mr. Ellis.

HENRY FARRINGTON, associate editor of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, was married on January 15 last to Miss Mary Johnston, of this city. Mrs. Farrington comes from a well-known Scottish family, and has been resident in this country for more than four years. Mr. Farrington is also from the "other side," as he was born in Liverpool, England, nearly twenty-eight years ago. He is a graduate of the Victoria University (B. Sc., honors, 1901; M. Sc., 1904) and also holds the honorary degree of B. Eng. of Liverpool University. Among other academic honors he is a Queen Victoria's prizeman in mathematics, and gained the first "distinction" in England in the Oxford Senior Local Examination, in 1898, in the subjects of magnetism and electricity. Mr. Farrington was a lecturer in engineering for three years at the London Polytechnic Institute, was mechanical editor for over a year with the J. B. Lippincott Company of Philadelphia, Pa., and was the editor of the department "Mechanical and Civil Engineering, Mechanic Arts and Trades," of Webster's New International Dictionary published by the G. & C. Merriam, of Springfield, Mass., last year. He has held his present appointment since March, 1909. Hearty congratulations are extended to Mr. Farrington by his many friends and especially his associates on the staff of this journal.

OBITUARY.

H. J. BUDDY died on January 15 after suffering only a few days from pleuro-pneumonia. Mr. Buddy was for eighteen years manager of the lighting, and power and mining departments of the Philadelphia district of the General Electric Company. He was identified with the electrical business since 1885, when he became associated with the Thomson-Houston Electric Light Company in Pennsylvania. He was born in Philadelphia forty-four years ago, and always made that city his home. He was highly esteemed by a host of friends, especially in electrical circles throughout the country. He was a member of the Merion Cricket Club, Haverford, Pa., the Art Club, Philadelphia, Pa., a member of the National Electric Light Association, and an associate member of the American Institute of Electrical Engineers. Mr. Buddy was a widower at the time of his death, and is survived by his father, a sister, and a brother.

JOHN TRUMBULL MARSHALL, assistant engineer of the lamp works of the General Electric Company, died in Bermuda, January 1, 1910, at the age of fifty. He was a direct descendant of Johnathan Trumbull, the American patriot, friend and adviser of Washington, and colonial governor of Connecticut. He graduated in 1881 from the Scientific Course of Rutgers College and went to work in the Edison Lamp Works at Menlo Park in October of that year. He has been continuously employed in the lamp works since that time. He invented and perfected the comparison method of photometering incandescent lamps, which is the method by which practically all commercial photometric measurements are made on incandescent lamps in lamp factories. This method requires no voltmeter or ammeter, but reads volts and amperes. Mr. Marshall was universally loved and respected. He was the president and leading spirit in the G. E. Outing Club and made their semi-annual outings the signal successes which they were. He was unmarried, and has always lived in Metuchen, N. J.

ELECTRICAL SECURITIES.

Although every tendency of the President and Congress has been to protect the business man, to regulate corporations and to prevent fraud, there has been a marked depression in the market. Contrary to the fact that January always is a time of improving values, there has been an effect quite to the contrary. Investors are, however, preparing for the rising market, which always comes in early spring. Money will become cheaper and more plentiful and the syndicates will soon begin to exploit their stocks.

The annual meeting of the American District Telegraph Company will be held January 27. Stockholders of record January 17 will be entitled to vote.

The annual meeting of the Cumberland Telephone and Telegraph Company will be held at Louisville, Ky., February 3.

The Shelburne Falls & Coleraine Street Railway has petitioned the Massachusetts legislature for authority to refund its funded debt and to fund the floating debt through issue of bonds not to exceed $100,000. The petitioning bill was referred to the senate committee on street railways.

Hooley, Learnard & Company announce that the $1,000,000 preferred stock of the United States Light and Heating Company, recently offered by them, has all been sold. The company has closed a contract with the Pullman Company for equipment for 130 new Pullman cars to go on the Atchison road.

The American Railways Company has had listed on the Philadelphia Stock Exchange 21,565 shares, or $1,078,250 additional capital stock, issued in connection with the acquisition of the Roanoke Traction and Light Company, the Lynchburg Traction and Light Company and the Johnstown Passenger Railway Company. The total amount of stock to be issued in this connection is 28,100 shares, or $1,405,000.

Notwithstanding the extremely bad weather and constant interruption of traffic this month, the Philadelphia Rapid Transit Company is said to have increased gross earnings over last year at the rate of $500 a day.

DIVIDENDS.

The American District Telegraph Company of New Jersey; regular quarterly dividend of one per cent, payable January 22.

Butte Electric and Power Company; regular quarterly dividend of one and one-quarter per cent upon the preferred capital stock, payable February 1.

The Columbus Street Railway Company; regular quarterly dividend of one and one-quarter per cent on the preferred stock, payable February 1 to stock of record January 15.

Electric Bond and Share Company; two per cent on common and one and one-quarter per cent on preferred; the former payable January 15, the latter February 1.

The Electric Company of America; semiannual dividend of three and one-half per cent, payable February 3 to stockholders of record January 10.

Guanajuato Power and Electric Company; one and one-half per cent upon the preferred stock, payable February 1.

Havana Electric Company; quarterly dividends of one and one-half per cent on the preferred stock and one per cent on the common stock, payable February 14. Books close January 22 and reopen February 15.

Mexican Light and Power; one per cent, payable January 15.

Milwaukee Electric Railway and Light Company; regular quarterly dividend of one and one-half per cent upon the preferred capital stock, payable January 31.

Pacific Gas and Electric Company; $150 on preferred stock, payable February 15.

Railway and Light Securities Company; initial dividend of two per cent on $1,000,000 common stock, payable February 1.

Railways Company General; quarterly dividend of one per cent, payable, February 1.

Rio de Janeiro Tramway Light and Power Company; a dividend of one per cent, payable February 1 to stockholders of record January 15.

United Gas and Electric of New Jersey; preferred semiannual dividend of two and one-half per cent, payable January 15.

United Traction Company of Pittsburg; semiannual dividend of two and one-half per cent on its preferred stock, payable January 20 to stockholders of record January 10.

Western Telephone and Telegraph preferred; semiannual dividend of two and one-half per cent, payable February 1.

Wheeling Traction Company; quarterly dividend of one per cent, payable January 15.

NEW YORK.

	Jan. 17.	Jan. 10.
Allis-Chalmers common	14	14⅞
Allis-Chalmers preferred	50	53⅞
Amalgamated Copper	85¼	88⅝
American Tel. & Cable	*80	80
American Tel. & Tel.	138	140¼
Brooklyn Rapid Transit	75¼	79
General Electric	154	159¼
Interborough-Metropolitan common	24¼	24½
Interborough-Metropolitan preferred	62	60¼
Kings County Electric	129	129
Mackay Companies (Postal Telegraph and Cables) common	89	90¼
Mackay Companies (Postal Telegraph and Cables) preferred	76½	77½
Manhattan Elevated	136½	136½
Metropolitan Street Railway	20	20
New York & New Jersey Telephone	123½	123½
U. S. Steel common	85½	88⅝
U. S. Steel preferred	123	124⅜
Western Union	74	76
Westinghouse common	73	81½
Westinghouse preferred		131½

*Last price quoted.

BOSTON.

	Jan. 17.	Jan. 10.
American Tel. & Tel.	138	140¼
Edison Elec. Illuminating	242	246
General Electric	154	159¼
Massachusetts Electric common	18¼	18½
Massachusetts Electric preferred	80	80
New England Telephone	134	136
Western Tel. & Tel. common	16	17
Western Tel. & Tel. preferred	93	93½

PHILADELPHIA.

	Jan. 17.	Jan. 10.
American Railways	48¾	49½
Electric Company of America	12¼	12¼
Electric Storage Battery common	60¾	61¼
Electric Storage Battery preferred	60¾	61¼
Philadelphia Electric	13⅞	14⅛
Philadelphia Rapid Transit	26¾	28
Philadelphia Traction	88	88¼
Union Traction	51⅞	52⅝

CHICAGO.

	Jan. 17.	Jan. 10.
Chicago Railways, Series 1	108½	108½
Chicago Railways, Series 2	39	39
Chicago Subway	43¼	43¼
Chicago Telephone	134½	134½
Commonwealth Edison	118	119
Metropolitan Elevated common	15⅞	16½
Metropolitan Elevated preferred	55	55½
National Carbon common	104	103
National Carbon preferred	121	120

PROPOSALS.

WIRING FOR MARINE HOSPITAL.—The office of Supervising Architect, Washington, D. C., will receive sealed proposals until February 18, 1910, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the laundry and attendants' quarters, United States Marine Hospital, Louisville, Ky., in accordance with drawings and specifications, copies of which may be had from the custodian at Louisville, Ky., or at the Supervising Architect's office.

WIRING FOR OFFICERS' QUARTERS, HOT SPRINGS, ARK.—Sealed proposals, in triplicate, for construction, heating, plumbing, wiring and electric fixtures of two double sets of officers' quarters at the Army and Navy General Hospital will be received here until February 7, 1910. The United States reserves the right to accept or reject any or all proposals or any part thereof. Envelopes containing proposals should be marked "Construction of Two Double Sets Officers' Quarters" and addressed to Major G. D. Deshon, quartermaster.

NAVY DEPARTMENT SUPPLIES.—The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will open bids on naval supplies on the dates given below. Bidders interested therein should make early application for copies of the schedules, giving the schedule numbers desired. Schedules can also be obtained upon application to the Navy Pay Office nearest each navy yard. The supplies on which bids asked are as follows:

Date of Opening.	Articles.	Quantity.	Delivery at Navy Yard.	Sched. No.
Feb. 1	Fixtures, truck light	8	Brooklyn, N. Y.	2160
	Reflectors, cargo	50	Brooklyn, N. Y.	2160
	Wireless telegraph sets	2	Brooklyn, N. Y.	2159
Feb. 8	Changing hand power elevator to electric driven		Annapolis, Md.	2175
	Equipment for power plant, installation & material	Miscellaneous.	Indian Head, Md.	2174
Feb. 21	Wireless telegraph sets		Various	2115

NEW INCORPORATIONS.

KANSAS CITY, MO.—The Western Storage Battery Company has been incorporated with a capital stock of $60,000.

ATHENS, GA.—The Athens Engineering Company has been incorporated by O. M. Roberts and Joel .Weir with capital stock of $7,000. This company will establish offices at 186 Clayton Street, Athens, and engage in electrical contracting, etc. B.

SPRINGFIELD, ILL.—The Eclipse Engine and Machine Company, Springfield, has been incorporated with a capital of $10,000 to manufacture and sell engines, electrical appliances, etc. The incorporators are D. M. Parkhill, C. L. Cook and J. H. Keith.

CINCINNATI, O.—The Toledo Electric Company has been incorporated with a capital stock of $75,000, by Claude B. DeWitt, M. H. Heatley, C. V. Baumgardner, S. B. Ransom and A. J. Scheuer. The organization has acquired the patents and right of the Toledo Electric Welding Company, of Toledo, and will erect and operate a plant here which will give employment to about one hundred men. It will manufacture, buy, sell and deal in a general way in electric welding and generating machinery and supplies.

INDUSTRIAL ITEMS.

THE CHAS. L. KIEWERT COMPANY, Milwaukee, Wis., agents for the well-known "Aurola" and "Alba" flaming arc lamps, recently opened a Chicago office at 125 Clinton Street, which is in charge of H. W. Fowzer.

THE KELLOGG SWITCHBOARD AND SUPPLY COMPANY, Chicago, Ill., announces that its proposed consolidation with the Kellogg & Dean Electric Company has not materialized and all steps in that direction have ceased.

THE HAZARD MANUFACTURING COMPANY, of Wilkes-Barre (Pa.), Pittsburg (Pa.), New York and Chicago, manufacturer of insulated wire, wire rope and similar products, is mailing to the trade, copies of its wall calendar for 1910.

THE NATIONAL METAL MOLDING COMPANY is sending out color-print postal cards showing the New West Boston Bridge between Boston and Cambridge, Mass. The wiring on this bridge is encased in "Sherarduct," which was selected on account of its rust-proof and non-corrosive qualities.

THE WESTERN ELECTRIC COMPANY, New York, N. Y., has issued a booklet on Bridging Telephones for Light Load Service. The new No. 1317-AH set is described and illustrated and the economy of this three-bar bridging telephone is set forth. A neatly arranged folder on the use of telephones in railway terminals gives a few reasons why telephones are used in this manner.

THE SWEDISH-AMERICAN TELEPHONE COMPANY of Chicago is distributing a booklet illustrating its Radio Ideal telephone holder, parlor telephone sets and other instruments. The Radio telephone holder will clamp on a desk, and is especially recommended as a convenience where more than one person uses a telephone. The company is also sending out a card describing its 125-volt switchboard dynamo.

THE DRIVER-HARRIS WIRE COMPANY, Harrison, N. J., has recently issued a booklet containing much valuable data and information regarding their resistance materials. The properties of each kind of wire are given, together with a table of weights, resistance per pound and resistance for varying temperatures. A table of decimals for each sixty-fourth of an inch and a table showing the difference between wire gauges are also given.

THE TOLEDO ELECTRIC WELDER COMPANY, of Toledo, Ohio, has increased its capital stock from $30,000 to $75,000 and will move to Cincinnati, Ohio, where it has closed a long lease on a two-story modern brick factory building 160 by 60 feet. A fine equipment of machine tools is being installed and the plant will be in full operation about February 1, manufacturing a complete line of electric welding machines for any kind of work.

THE LORD ELECTRIC COMPANY, of New York, N. Y., has received an order for Earll Retrievers and Catchers, as a direct result of a test made by a foreign municipality. Out of twelve styles which were installed, only the Earll was satisfactory. An interesting fact is that these retrievers will be handled by female conductors. The Lord Electric Company is also sending out slips illustrating its M. G. V. cell lightning arrester, the Heany arc lamp and the Bradshaw skid.

THE NATIONAL ELECTRIC LAMP ASSOCIATION states in a recent leaflet that the announcement that its Madza lamp has been placed on the market is giving rise to some misunderstanding. Although the Madza lamp has at present a tungsten filament it is not intended to restrict the lamp to these filaments alone. It is therefore not "just an ordinary tungsten lamp." Should a better filament be discovered later it will be used. It is, in fact, the intention of the association that the Madza lamp will always be the best and latest.

BLACK & LODER COMPANY, 30 Church Street, New York, N. Y., has, in a recently issued pamphlet, set forth very concisely some of the ways in which central stations may increase their profits. This little booklet, "The Development of Profit Factors," shows the necessity of increasing the plant efficiency and of practicing judicious economies. The central station manager's view of his plant is often warped by too close a view and hence the advantage of employing the services of business engineers to study the problems of economy.

THE SARGENT STEAM METER COMPANY, 271-285 Madison Street, Chicago, in a recent booklet, "Instruments of Precision," describes its automatic gas calorimeter and its accessories. The instrument is treated as a whole and each part of it is also illustrated and its action fully explained. A number of points of superiority are enumerated, among which is that of great accuracy. As the water is weighed instead of being measured there is no temperature error. Through entirely automatic operation, all personal error is avoided. These meters are in fact accurate to .001 cubic feet.

THE BROWN HOISTING MACHINERY, Cleveland, Ohio, has issued an attractive booklet showing a number of buildings roofed with "Ferroinclave." The crimped steel sections after being fitted together are covered with cement, making a solid fire-proof roof. The upper side of the cement covering may also be protected by waterproof covering. Several illustrations of "Ferroinclave" flooring are also shown. Much the same construction is used in the bridge, stairways and coalbins contained in the booklet. A set of curves shows the safe load of "Ferroinclave" slabs with various thicknesses of concrete.

THE C. H. WORCESTER COMPANY, of Chicago, has published a circular relative to cedar poles, in which it calls attention to the great diameter near the butt of its Munising poles and the marked increase of life resulting therefrom. It has been found that poles decay almost entirely at the grade line; large girth of the pole at this point therefore materially adds to the strength and useful life of the pole. The company carries a large stock of Munising poles, whose butt diameter is much larger than that required by the standard specifications of the American Telephone and Telegraph Company.

THE UNITED STATES LIGHT AND HEATING COMPANY, of 30 Church Street, New York, N. Y., has just issued bulletin 108, illustrating and describing their line of "National" storage batteries. The bulletin contains much valuable matter in the form of instructions for the care and operation of batteries. Much of this has been written expressly for the garage attendant, but any battery user will find information which is of use to him. Several diagrams are given, showing the method of taking voltage readings, testing coils and connecting for emergency use. A list is also given of the previous bulletin which the company has issued.

THE ALLIS-CHALMERS COMPANY, of Milwaukee, Wis., has been awarded a contract for mine pumping by the Lake Superior Iron and Steel Company, of Sault Ste. Marie, Ont. This consists of three two-stage, horizontal-shaft, centrifugal pumps, each having a capacity of 4,200 gallons per minute against a head of 160 feet. The suction and discharge nozzles are each twelve inches in diameter and the pumps will be fitted with balancing disk to prevent end thrust. Each pump will be direct-connected to a 260-horsepower, 2,200-volt, twenty-five cycle, three-phase, constant-speed, induction motor of the open squirrel-cage type. Potential starters will also be furnished.

THE ELECTRIC STORAGE BATTERY COMPANY has ready for distribution a small booklet giving condensed instructions for the operation of "Exide" and "Hycap-Exide" storage batteries. Great care has been exercised in the preparation of this booklet so as to eliminate all matter which is too technical for the ordinary storage battery user. This instruction book contains information that will aid a user in charging, and in deriving the proper service from a battery. The booklet is well arranged and carefully indexed in the margins so that desired information can be referred to with little trouble. Copies of this publication will be mailed to interested persons from any of the offices of the company.

THE HOLOPHANE COMPANY has published a page pamphlet entitled "The Lighting of Mills and Factories." This is probably the most ambitious effort so far made to present the practical problems of mill lighting from the standpoint both of the illuminating engineer and the salesman of electric lighting equipment. The booklet is profusely illustrated with photographs of actual installations showing good and bad methods of lighting metal-working machines, looms, warpers, spinners, sewing machines, skiving machines, etc. There are also numerous diagrams showing the proper arrangement of lamps and reflectors for various classes of service. The company has given many months of study to industrial lighting and in this publication places the results of this investigation in handy form for engineers and salesmen. The booklet is offered without charge on application to any offices of the company.

THE CROCKER-WHEELER COMPANY of Ampere, N. J., has recently sold more than 5,000 horsepower in direct current motors, approximately 2,000 kilowatts in direct current generators and 2,000 kilowatts in alternating current generators. Prominent among these sales is one to the Bethlehem Steel Company of South Bethlehem, Pa., of five compound wound interpole motors with a total output of 3,600 horsepower. Two of these machines have a capacity of 1,000 horsepower each. This company has also ordered nineteen of the well known C-W mill motors with a combined capacity of nearly 800 horsepower. Another order calls for one 1,200 kilowatt alternating current generator to be used for light and power in the plant of Miami Copper Company, Globe, Ariz. Among the orders for alternating current apparatus is one for the plant of the Virginia Bridge and Iron Company, calling for two 200 kilowatt, three phase, 2,300-volt synchronous motors. Other important sales are as follows: Two 2,300-volt, three phase alternators with a combined capacity of 280 kilowatt to be shipped to the Weston Electric Light Company, Weston, Mass.; one 600 kilowatt, 600-volt, three phase alternator for the Landes, Frary & Clark Company, New Britain, Conn.

DATES AHEAD.

Central Electric Railway Association. Next meeting at Indianapolis, Ind., January 27, 1910.

San Francisco Electrical Exposition, January 29-February 5, 1910.

Toledo Electrical Show, Coliseum, Toledo, O., January 31-February 5, 1910.

Philadelphia Electrical Exposition, Philadelphia, Pa., February 14-26, 1910.

Missouri Electric, Gas, Street Railway and Water Works Association, next convention at Jefferson City, Mo., on April 14, 15 and 16.

Florida Electric Light and Power Association, next meeting at Tampa, Fla., April 21, 1910.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) January 11, 1910.

945,784 COMMUTATOR TRUING MACHINE. Osman E. Hunt, Eagle Grove, Iowa. Filed November 13, 1908. The machine is adapted for truing the commutator in situ.

945,822. ELECTRICAL APPARATUS FOR MELTING SEALING WAX. William T. Von Tillow, San Francisco, Cal. Filed December 14, 1908. The heating resistance is disposed about the restricted end of a tube closed by an exteriorly mounted gate.

945,823. APPARATUS FOR EXHAUSTING INCANDESCENT LAMPS. Frank L. O. Wadsworth, Pittsburg, Pa. Filed March 17, 1906. A socket for the reception of the tubulature of an incandescent lamp bulb is provided in a fluid pressure column connected to an air pump, and devices are arranged in the column to vary the strength of the current through the lamp in successive stages at predetermined intervals.

945,856. JUNCTION BOX. Thomas E. Murray, New York, N. Y. Filed June 21, 1909. Circuit conductors are arranged in a block having a channel with a peripheral groove near one end, and a removable plate seated in the groove.

945,865. METHOD OF CLEANING METAL ARTICLES. James D. Phillips and Carl Hambuechen, Madison, Wis. Filed August 6, 1909. The articles to be cleaned are immersed in a suitable electrolyte in conjunction with a cleaning metal electropositive thereto, and electrical contact is provided between the articles and the cleaning metal through an auxiliary metal electronegative to the cleaning metal.

945,866. APPARATUS FOR CLEANING METAL ARTICLES. James D. Phillips and Carl Hambuechen, Madison, Wis. Filed August 6, 1909. The apparatus comprises a cleaning metal electropositive to the articles to be cleaned, and having projecting portions presenting clean surfaces for making contact with the articles.

945,890. SPARK-PLUG. Otto C. Winestock, Perkinsville, Vt. Filed October 26, 1908. A fixed member has bayonet-joint grooves, and a removable member has parts co-acting with these grooves to lock the removable member to the fixed member.

945,912. ELECTRIC CASH REGISTER. Joseph P. Cleal, Toronto, Ontario, Canada, assignor to the National Cash Register Company, Dayton, Ohio. Filed February 28, 1907. Two motors are successively operated to move an element of the operating mechanism in its forward and reverse direction.

945,917. EFFECTING INTERCHANGE OF ELECTRIC CHARGES BETWEEN SOLID CONDUCTORS AND GASES. Frederick G. Cottrell, Berkeley, Cal., assignor to International Precipitation Company, San Francisco, Cal. Filed July 13, 1908. Electrified solid conductors and gases are brought into contact with one another at a pubescent surface.

945,923. DUPLEX TWO-POLE SWITCH. Parker Dunning, Schenectady, N. Y., assignor to General Electric Company. Filed July 10, 1907. Two switches pivoted on a common axis are closed by a coil spring on the axis, and either switch may be opened without disturbing the other.

945,925. SYSTEM OF POWER DISTRIBUTION. William L. R. Emmet, Schenectady, N. Y., assignor to General Electric Company. Filed April 5, 1909. In this system there are a propeller and a low-speed, high-pressure, reciprocating engine on each shaft, a high-speed, low-pressure turbine driven by the engine exhaust, an electric generator driven by the turbine, electric motors to operate at the same speed and mounted one on each of the aforesaid shafts and co-operating with the engines to drive the shafts.

945,940. RANGE TRANSMITTER. John L. Hall, Schenectady, N. Y., assignor to General Electric Company. Filed August 7, 1908. A number of electric push buttons are arranged in columns, so that all the buttons in one column only are released when any one button in that column is depressed, etc.

945,942. ARC LAMP. Charles E. Harthan and William H. Dalton, Lynn, Mass., assignors to General Electric Company. Filed December 10, 1904. The movement of an armature pivoted in co-operative relation to the magnet core, is arrested by an electromagnetic stop actuated by the magnet.

945,960. CARBON FEEDING MECHANISM FOR ARC LAMPS. Ladislav O. Kozar, Wilkes-Barre, Pa., assignor of one-third to Joseph Murgas, Wilkes-Barre, Pa. Filed August 9, 1909. The freely rotating feed wheel is provided with a braking surface and a band brake.

945,964. PASSENGER ELECTRIC RAILWAY CAR. Frederick H. Lincoln, Philadelphia, Pa. Filed April 19, 1909. The main car circuit is broken when a door is opened.

945,969. PUSH BUTTON SWITCH RECEPTACLE. Norman Marshall, West Newton, Mass., assignor to the Arrow Electric Company, Hartford, Conn. Filed September 21, 1909. Describes a snap-switch receptacle.

945,976. SYNCHRONIZING APPARATUS. George P. McDonnell, St. Louis, Mo., assignor to Claude A. Lindborg, St. Louis, Mo. Filed June 26, 1908. Describes an electrically synchronized biophotophone.

945,990. SYSTEM OF ILLUMINATION. Charles P. Steinmetz, Schenectady, N. Y., assignor to General Electric Company, a corporation of New York. Filed June 21, 1907. A metal-filament lamp is permanently connected in circuit with each auxiliary anode of a vapor-electric device having main anodes and a cathode.

945,991. VAPOR ELECTRIC SYSTEM. Charles P. Steinmetz, Schenectady, N. Y., assignor to General Electric Company. Filed June 21, 1907. A vapor-electric device having anodes and a cathode has auxiliary anodes continuously connected to the alternating-current mains, and reactances in circuit with the auxiliary anodes and each having a portion in circuit with one of the main anodes.

945,993. RESISTANCE UNIT. Elihu Thomson, Swampscott, Mass., assignor to General Electric Company. Filed December 2, 1904. Granulated silicon is packed within a quartz tube, and conducting terminals contact with the silicon.

945,995. CONNECTOR FOR ELECTRIC CONDUCTORS. Harry G. Weeks, Pittsfield, Mass., assignor to General Electric Company. Filed August 3, 1908. A connector for electric conductors comprises a casing having three apertures, two of which contain circuit terminals, and a co-operating member has three terminals arranged to enter the apertures and engage the two terminals.

945,997. CENTRIFUGAL SWITCH. John B. Wiard, Lynn, Mass., assignor to General Electric Company. Filed August 6, 1908. A switch for an alternating-current motor operates by centrifugal force when the motor is up to speed.

946,009. PRIMARY BATTERY. Thomas W. Byrne, Boston, Mass. Filed December 24, 1908. Describes a form of zinc-carbon cell.

946,024. APPARATUS FOR PRODUCING COMBINATIONS OF HOLES IN PAPER BANDS. Erwin Ehrhardt, Pankow, near Berlin, Germany, assignor to Siemens & Halske, A. G., Berlin, Germany. Filed July 14, 1908. Electromagnets, each operating independent perforators, are energized and de-energized successively at predetermined time intervals.

946,027. ADJUSTABLE SUPPORT FOR VAPOR LAMPS. Stanwood E. Fletcher, Englewood, N. J., assignor to Cooper Hewitt Electric Company, New York, N. Y. Original application filed July 28, 1904. Divided and this application filed January 9, 1905. The lamps are supported by a common pivot rod in an open frame.

946,034. MECHANICAL DIRECTORY. Frank G. Hall, Riverside, Cal. Filed November 16, 1907. An electrically operated mechanism actuates the rolls.

946,040. ELECTROLYTIC CELL. Joseph L. R. Hayden, Schenectady, N. Y., assignor to General Electric Company. Filed Aug. 20, 1909. The vessel contains a layer of heavy nonconducting liquid at the bottom and a body of electrolyte above the heavy liquid. Electrodes, connected to terminals submerged in the heavy liquid, project upwards into the electrolyte.

946,045. SYSTEM OF ELECTRICAL DISTRIBUTION. Albert S. Hubbard, Belleville, N. J., assignor to Gould Storage Battery Company. Filed Feb. 19, 1906. Means for automatically affecting the battery current (auxiliary to the main generator circuit) are affected by current changes of the system and arranged to affect oppositely the battery current for similar changes on the system.

946,053. MEANS FOR STARTING SERIALLY-OPERATED VAPOR CONVERTERS. Frederick H. von Keller, New York, N. Y., assignor to Cooper Hewitt Electric Company. Filed March 8, 1907. Means are brought into operation by the starting of the first rectifier for causing direct current to pass through the main negative electrode and the temporary starting electrode of the second rectifier.

946,068. MEANS FOR EXHAUSTING INCLOSED RECEIVERS. Max von Recklinghausen, New York, N. Y., assignor to Cooper Hewitt Electric Company, New York, N. Y. Filed July 30, 1904. An insulating vessel inside a closed container holds a conducting liquid. A material in the vessel is adapted to remove gases from the container.

946,070. ELECTRIC LAUNDRY IRON. Earl H. Richardson, Ontario, Cal., assignor to Pacific Electric Heating Company, Ontario, Cal. Filed February 15, 1909. There are a number of heating units each comprising a core with wire wound thereon.

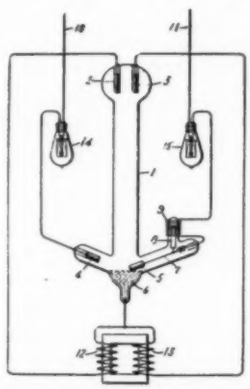
946,079. ELECTRODE FOR VAPOR ELECTRIC APPARATUS. Percy H. Thomas, East Orange, N. J., assignor to Cooper Hewitt Electric Company, New York, N. Y. Filed February 10, 1904. The electrode consists of a conducting hardened paste, a portion of which adheres to the walls of the container and surrounds the leading-in wires.

946,080. LIGHTNING ARRESTER. Percy H. Thomas, Montclair, N. J., assignor to Cooper Hewitt Electric Company, New York, N. Y. Filed September 27, 1905. In combination with an alternating-current circuit is a suitable ground, and in the ground circuit there are a series of vapor devices, a spark gap, and a number of shunts (for the vapor devices) each containing a condenser.

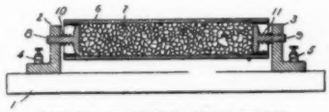
946,090. MACHINE FOR ARMORING CABLES. Emil Witzenmann, Pforzheim, Germany. Filed November 10, 1908. A sliding metal-tape winding head is located between reel-supporting trunnions, and rollers are mounted resiliently on the winding head so as to yield radially.

946,105. DYNAMO-ELECTRIC MACHINE. John W. Burleigh, Taunton, England, assignor to Zone Dynamo & Motor Patents Company Limited, London, England. Filed August 10, 1908. Two field-magnet cores are excited by an arched coil and an ogee coil the straight parts of both of which lie alongside of each other in a neutral zone and close over and parallel with the axis of the armature.

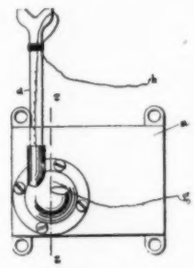
946,135. SUPPORTING DEVICE FOR TROLLEY WIRES OF ELECTRIC RAILWAYS. Kalman von Kando, Vado Ligure, Italy, assignor to George Westinghouse, Pittsburg, Pa. Filed October 2, 1908. A horizontally projecting arm carries an insulator on which are pivoted rods which when prolonged meet in a point on the same level as the point of attachment of the trolley wire and an attachment piece pivoted to the free ends of the rods, the trolley wire being fixed to the lower extremity of the attachment piece.



945,990.—SYSTEM OF ILLUMINATION.



945,993.—RESISTANCE UNIT.



946,364.—RESISTANCE DEVICE.

946,148. SECONDARY ELECTRIC CLOCK. Thomas Mungall, Chicago, Ill. Filed June 1, 1909. A pawl engaging with a pendent magnet armature lever is thereby advanced when the magnet is energized.

946,156. ARC-LAMP. Walter D'A. Ryan, Lynn, Mass., assignor to General Electric Company. Filed November 18, 1903. A pivotal connection is provided between a pair of pivoted separately movable electrodes and a pivoted dashpot.

946,157. SWITCH CONSTRUCTION. William M. Scott, Philadelphia, Pa., assignor to The Cutter Electrical and Manufacturing Company. Filed June 5, 1909. A lug on the top plate extends over the closure member to hold it.

946,166. SPACE TELEGRAPHY. John S. Stone, Cambridge, Mass. Filed February 27, 1906. The system comprises a power circuit including a generator, a sonorous circuit operatively associated with the generator, a radiating system related to the sonorous circuit, a circuit connected across the terminals of the generator and including a condenser, and a metallic connection from one armature of the condenser to the frame of the generator.

946,167. SPACE TELEGRAPHY. John S. Stone, Boston, Mass. Filed February 7, 1907. Describes an electromagnetic wave transmitting system.

946,168. SPACE TELEGRAPHY. John S. Stone, Boston, Mass. Original application filed February 27, 1906. Divided and this application filed March 12, 1908. Similar to No. 946,166.

946,192. METHOD FOR OBTAINING METALLIC ATTACHMENTS FOR INCANDESCENT LAMPS. Pierre Azaria, Paris, France. Filed July 28, 1909. Metallic filaments for incandescent lamps are autogeneously soldered to their holders by causing an electric current to pass through conductors of refractory material placed near the points where the soldering is to be effected and heating them by radiation.

946,193. ELECTROMAGNET. Emile Bachelet, New York, N. Y. Filed February 18, 1907. At one end of the coil is a metallic deflecting plate, and at the other end a movable screen of magnetic material.

946,202. ELECTRIC SIGNALING APPARATUS FOR RAILWAYS. William J. Cook, Denver, Colo., assignor to The Cook Railway Signal Company, Denver, Colo. Filed March 2, 1909. A strain on a device located above a danger point on the track breaks the circuit and actuates the signal.

946,212. DYNAMO-ELECTRIC MACHINE. Ray Flagg, St. Louis, Mo., assignor to Wagner Electric Manufacturing Company, St. Louis, Mo. Filed February 1, 1909. A winding projecting beyond the core of a dynamo-electric machine is provided with a flexible support for its ends.

946,215. ELECTROMAGNETIC DEVICE. Harry G. Geissinger, New York, N. Y., assignor to Geissinger Regulating Company, New York, N. Y. Filed April 12, 1909. Means mechanically independent of an electromagnet armature are provided for varying the current through the energizing windings thereof, dependent on the position of the armature.

946,220. CIRCUIT-BREAKER. Edward M. Hewlett, Schenectady, N. Y., assignor to General Electric Company. Filed July 29, 1907. A trip is controlled by a thermostatic device.

946,230. KEYBOARD-OPERATING MECHANISM. Hans Knudsen and Hans Barta, London, England. Filed May 3, 1909. Describes a method of synchronizing electrically the operation of two separate keyboard mechanisms.

946,251. ELECTRICAL-FUSE BLOCK. Andrew A. Moffitt and George E. Andrews, Providence, R. I. Filed July 23, 1909. In order to permit of electrical contact of the fuse terminals of a number of contact clips, a cartridge fuse having an extended member must be inserted in a perforation correspondingly shaped to receive the member.

946,258. SIGNALING APPARATUS AND CIRCUITS THEREFOR. James G. Nolen, Chicago, Ill., assignor to Automatic Fire Protection Company. Filed April 25, 1904. A motor-driven wheel has two unsymmetrically located apertures engaging with respective parts of a movable electromagnetically controlled stop device.

946,259. COMBINED BURGLAR-ALARM AND TELEPHONE SYSTEM. James G. Nolen, Chicago, Ill., assignor to John E. Shepherd, Chicago, Ill. Filed May 23, 1907. A protective system at a party's station includes devices for actuating the line signal if the line is idle, or the supervisory signal of the line is busy.

946,267. ELECTRICALLY-OPERATED HAMMER. Louis Paulero, Petersburg, Va., assignor to The Virginia Electric Tool Manufacturing Company, Petersburg, Va. Filed June 27, 1908. The plunger is actuated by a solenoid.

946,270. TELEPHONE ADJUNCT. Alcorn Rector, New York, N. Y., assignor to Rector Help-A-Phone Company, New York, N. Y. Filed December 4, 1908. The device comprises two hollow earpieces with a sound-transmitting connection between them.

946,287. LOCK-OUT DEVICE FOR TELEPHONES. Charles W. Throckmorton, Pittsburg, Pa. Filed March 12, 1907. Spring-actuated complemental means at each subscriber's station are governed by a selective circuit-controller at the central station.

946,309. SWITCH-HANDLE. Carl E. Anderson, Bridgeport, Conn., assignor to The Perkins Electric Switch Manufacturing Company, Bridgeport, Conn. Filed August 17, 1909. The handle is free to rotate in one direction without affecting the switch handle or the securing means between the handle and the switch spindle.

946,344. ELECTROMAGNETICALLY-OPERATED VALVE. Albert Gaudin and Edmond Tellier, Douai, France. Filed April 23, 1906. A dog attached to the armature of an electromagnet engages with a tooth to move the valve.

946,364. RESISTANCE DEVICE. George Hookham, Birmingham, England. Filed March 13, 1909. A variable resistance element comprises a resistance wire, a mercury column, a vessel containing liquid which expands when heated, and a diaphragm separating the liquid from the mercury column.

946,372. KEYBOARD TELEGRAPHIC TRANSMITTER. Edward E. Kleinschmidt, New York, N. Y. Filed February 7, 1905. Selective bars are provided with lugs such that one lug represents a dot and two or more respresent dashes.

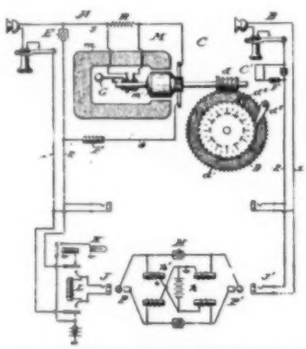
946,395. PULL-SOCKET FOR INCANDESCENT LAMPS. Henry T. Paiste, Philadelphia, Pa. Filed March 18, 1908. Describes an arrangement of pawl and ratchet wheel.

946,380. TELEPHONE METER SYSTEM AND APPARATUS. Ray H. Manson, Elyria, Ohio, assignor to The Dean Electric Company, Elyria, Ohio. Filed April 18, 1907. A common-battery telephone system comprises a line circuit, speech-transmitting and receiving instruments, a time registering device, and an electric motor energized from the circuit and connected to the time registering device to operate the same only upon the flow of current in a predetermined direction.

946,381. TELEPHONE METER SYSTEM AND APPARATUS. Ray H. Manson, Elyria, Ohio, assignor to The Dean Electric Company, Elyria, Ohio. Filed April 18, 1907. An electrically-operated time-registering device energized from one of the subscribers' circuits is arranged to register only the time during which both of the line circuits are in talking condition.

946,382. TELEPHONE METER SYSTEM AND APPARATUS. Ray H. Manson, Elyria, Ohio, assignor to The Dean Electric Company, Elyria, Ohio. Filed April 18, 1907. The flow of current is reversed so as to operate the meters at both ends of the line when a through talking connection is established.

946,394. MAGNETIC ORE-SEPARATOR. Gustaf E. Ohrn, New York, N. Y., assignor to American Grondal Kjellin Company, New York, N. Y. Filed June 15, 1909. Includes a magnet and revolving drum.



946,380.—TELEPHONE METER SYSTEM.

946,409. CUT-OUT. Joseph G. Swallow, Brooklyn, N. Y., assignor of one-third to Walter E. McCoy and one-third to Frank W. Smith, New York, N. Y. Filed June 6, 1908. The cut-out block has an insulating base recessed to receive a fuse-plug receptacle, and means to carry a fuse above the receptacle.

946,410. PORTABLE TELEPHONE TRANSMITTER AND RECEIVER OR TESTING INSTRUMENT. Henry F. Thoma, Jr., and Clifford E. McGrew, Chicago, Ill., assignors of one-half to Henry F. Thoma, one-fourth to Henry F. Thoma, Jr., and one-fourth to Clifford E. McGrew, Chicago, Ill. Filed December 14, 1907. Describes a compact combination of receiver and transmitter.

946,413. ELECTRICAL-CIRCUIT PROTECTOR. Richard Wiesinger, Adrian, Mich., assignor to William G. Nagel, Toledo, Ohio. Filed December 29, 1903. A heat cartridge is released from suspension under an excess of heat.

946,418. COMBINATION SWITCH AND LIGHTNING-ARRESTER. Samuel W. Wood and Edwin T. Thoma, Lookeba, Okla. Filed May 25, 1909. Describes a form of switch and lightning-arrester for telephone and telegraph wires.

946,426. BLOCK-SIGNALING SYSTEM FOR RAILROADS. Olney M. Felix and George Gray, Owensboro, Ky. Filed December 19, 1908. An electrically-operated semaphore is biased to the danger point.

946,431. SIGNALING SYSTEM. John L. Hall, Schenectady, N. Y., assignor to General Electric Company. Filed April 1, 1907. Motor-controlled means open a maintaining circuit after a short predetermined interval.

946,434. CARBON-HOLDER. Herman L. Hartenstein, Constantine, Mich., assignor to Continental Investment Company, Duluth, Minn. Filed November 19, 1906. Renewed August 20, 1909. Comprises a supporting arm and a longitudinally movable wedge device for clamping the carbon to the arm.

946,435. CARBON-HOLDER. Herman L. Hartenstein, Constantine, Mich., assignor to Continental Investment Company, Duluth, Minn. Filed March 11, 1907. Renewed August 20, 1909. Describes a form of holder for a dipping electrode.

946,457. ELECTRICALLY-CONTROLLED SQUARING MECHANISM FOR SHEARING-MACHINES. Edmund Miles, Harrisburg, Pa., assignor of one-third to Charles Franklin McCann and one-third to Wesley James Dice, Harrisburg, Pa. Filed August 16, 1906. Renewed June 11, 1906. Electromagnetic clutches are provided to clutch respectively the power shaft and the feed mechanism.

946,473. SYSTEM OF DISTRIBUTION. Charles P. Steinmetz, Schenectady, N. Y., assignor to General Electric Company. Filed August 13, 1909. Generators are connected to the sections of a busbar, and reactances are included between adjacent sections.

946,487. ELECTROMAGNET. Elmer A. Burlingame, San Francisco, Cal., assignor to Burlingame Telegraphing Typewriter Company. Filed July 13, 1908. The magnet has two circuits, one in secondary relation to the other.

946,489. ELECTRICAL RELAY OR ELECTROMAGNET. Edward E. Clement, Washington, D. C., assignor to The North Electric Company, Cleveland, Ohio. Filed December 16, 1905. Levers are rocked by a plunger core to actuate the contact springs mounted on the (magnetic) frame parallel to the core.

946,502. ALTERNATING-CURRENT MOTOR. Valere A. Fynn, London, England. Filed July 20, 1905. Describes a form of repulsion motor.

946,503. SINGLE-PHASE COMMUTATOR-MOTOR. Valere A. Fynn, London, England. Filed October 5, 1906. A switch is provided for short-circuiting that part of the field winding which is disposed on the rotor so as to include a compensating electromotive force within the closed circuit.

946,504. ALTERNATING-CURRENT MOTOR AND GENERATOR. Valere A. Fynn, London, England. Filed December 21, 1906. Describes a form of polyphase motor.

946,505. ALTERNATING-CURRENT MOTOR. Valere A. Fynn, London, England. Original application filed December 21, 1906. Divided and this application filed March 6, 1906. The stationary member has a neutralizing winding and a teaser winding.

946,511. METHOD OF MANUFACTURING CARBID. Herman L. Hartenstein, Constantine, Mich., assignor to Continental Investment Company, Duluth, Minn. Filed February 13, 1907. Lime is fused in the electric furnace with a mixture of anthracite coal and artificial carbon.

946,528. APPARATUS FOR TELEPHONE LINES. Claude D. Enochs, La Crosse, Wis., assignor to The Vote Berger Company. Filed November 12, 1906. A signal lamp between one side of the cord-plug circuit and the ring of the plug is illuminated when the receiver is on its hook, and is shunted out otherwise.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired January 17, 1910:

489,913. FAN. Frank J. Agabeg, Charanpore, India.

489,938. ELECTRIC BATTERY. John H. Davis, Detroit, Mich.

489,944. ELECTRIC RAILWAY SWITCH. August C. Goetz, Milwaukee, Wis.

489,972. ELECTRIC CAR BRAKE. Andrew C. Miller, Auburn, N. Y.

489,983. ELECTRIC CUT OUT. William B. Potter, Lynn, Mass.

489,990. TELEPHONE. Chas. E. Scribner, Chicago, Ill.

490,011. ELECTRIC METER. Fernando J. Dibble, Peabody, Mass.

490,012 and 490,013. ELECTRIC TELEMETER TRANSMITTER. Fernando J. Dibble, Peabody, Mass.

490,014. ELECTRIC TELEMETER SYSTEM. Fernando J. Dibble, Peabody, Mass.

490,034. ELECTRIC HEATER. Thomas E. Morford, Minneapolis, Minn.

490,064. TELEGRAPHY AND TELEPHONY. Fred H. Brown, Chicago, Ill.

490,082. ELECTRIC HEATER. Jas. F. McLaughlin, Philadelphia, Pa.

490,161. ELECTRIC ALARM CLOCK. Joseph A. Nadeau, Detroit, Mich.

490,178. ELECTRIC CIRCUIT BREAKER. Elihu Thomson, Swampscott, Mass.

490,202 and 490,203. METHOD OF TESTING WATCH BALANCES AND HAIR SPRINGS. Geo. E. Hunter, Elgin, Ill.

490,231. GALVANIC BATTERY. Noah M. Powell, Galesburg, Ill.

490,248. ELECTRIC RAILWAY SYSTEM. Thomas Harris, Detroit, Mich.

490,256. ELECTRICALLY HEATED SOLDERING IRON. Geo. R. Meitzler, Cincinnati, Ohio.